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ABSTRACT

The samplers of aquatic activities that are contained in this guide have been reviewed and trial tested for use with both elementary and secondary level students. The activities were a result of South Carolina Sea Grant's efforts to expand marine education opportunities in the state. The table of contents alphabetically lists the activities according to whether they are for field or classroom use and indicates their related content and skill areas. A title page for each activity includes information on the activity's source, related subject and skill areas, and recommended grade levels. Student activity sheets are provided for several of the samplers and can be duplicated for classroom use. The following are representative of the offerings: beach exploration; freshwater marsh succession; salt marshes; ocean currents; Japanese fish printing; clam siphons; and rocks and shells. References and ordering information are also provided. (ML)

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Sea Sampler

Aquatic Activities for the Field and Classroom

Elementary

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SEA SAMPLER

AQUATIC ACTIVITIES FOR THE FIELD AND CLASSROOM

Elementary, Grades K-6

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PROJECT BACKGROUND AND PURPOSE

The samplers of aquatic activities are part of an evolutionary process designed to bring marine education into the curriculum of South Carolina schools. Before describing the evolution of the elementary and secondary activity samplers, we would like to define marine education as it is being used in South Carolina.

Marine education is very aptly defined in a publication by Goodwin and Schaadt:

> "Marine and aquatic education is that part of the total educational process which enables people to develop a sensitivity to and general understanding of the role of the seas and freshwater in human affairs and the impact of society on the marine and aquatic environments."[1]

Thus, marine education is not a subject but rather a process that can be used in any subject area to increase awareness and understanding of our water resources. It can also be used as a tool to stimulate and increase interest and learning in many study areas.

A concerted and coordinated effort to expand K-12 marine education opportunities in the state was initiated in 1980 when the South Carolina Sea Grant Consortium formed a committee to review K-12 marine education needs. The study committee agreed that all of us need to be more informed about our water world and learned that very little marine education was included in the K-12 curriculum. A plan was proposed to address this need: identify available resource materials, develop new materials, if necessary, and train teachers with these materials.

Elementary marine education materials from across the Nation were gathered and reviewed by Liu and Allen.[2] Secondary marine education materials were also reviewed and trial-tested by teachers who participated in our first marine education course, held summer, 1982. This core group of teachers returned for two reunions, reported on their experiences using the curricular materials, and identified activities which worked well with their students. Two additional summer courses and four workshops were held for elementary and secondary teachers over the next two years.

In summary, a total of 149 teachers gained information on coastal ecosystems and practice using field and classroom activities from a variety of sources. They also identified preferred activities and areas that were not adequately addressed by existing materials. Every participant selected and received curriculum materials to use in the classroom. Clearly, not only have the teachers benefited from the marine education training program, they have also contributed a wealth of information regarding which activities are most appropriate for use in South Carolina.

We have used this valuable information to compile elementary and secondary activities from different sources. Thus, the elementary and secondary versions of Sea Sampler - Aquatic Activities for the Field and Classroom, represent a sampling of activities that have been successfully used in South Carolina classrooms. We hope you too will use these activities to stimulate interest and increase your students' understanding of our watery world.

[1]H. L. Goodwin and J. G. Schaadt, 1978, " A Statement on the Need for Marine and Aquatic Education". Delaware Sea Grant College Program, University of Delaware, College of Marine Studies, Newark, DE 19711.

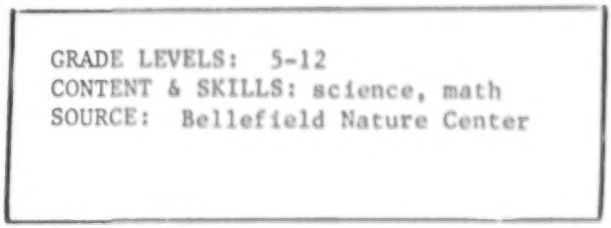
[2]J. M. Liu and W. B. Allen, 1982, "The Search and Review of Elementary Marine Education Materials". South Carolina Sea Grant Consortium, 221 Fort Johnson Road, Johns Island, Charleston, SC 29412.

HOW TO USE THIS SAMPLER

The activities in this sampler are designed to be used and infused as you see fit. They do not represent a complete unit of study and thus, should be used as starting points or complements to your regular curriculum. A table listing the activities and their content and skill areas is included at the end of this section to help you place the activities into your curriculum.

The activities are grouped alphabetically according to whether they are for field or classroom use. Guidelines for setting up a salt water aquarium preceed the field and classroom activities. A salt water aquarium can be an excellent learning resource for any classroom and this information is included to complement the sampler activities involving aquarium animals.

The title page of each activity contains a box in the upper right hand corner with information on the source of the activity, content and skills covered, and recommended grade levels (see sample below).



The grade levels are guidelines only. Please use your own discretion in determining whether or not an activity is appropriate for your learner group.

Some of the original activities have been slightly adapted so as to be more relevant to South Carolina, while others are simply retyped versions of the originals. We encourage you to obtain copies of the original curriculum units in order to expand your marine education studies. The ordering information for each activity source is included at the end of the packet.

Several of the activities contain student activity sheets. These are color-coded in blue for easy recognition and can be readily copied for your students.

Attached at the back of the sampler is an evaluation form. We are very interested in learning which activities you used and how you rate them. Please take a few minutes to evaluate the sampler after you have used it and return the form to:

SEA SAMPLER
USC Baruch Marine Lab
PO Box 1630
Georgetown, SC 29442

Thank you in advance for your contribution to this project. Now, go get your feet, or at least your hands, wet in these activities.

ACTIVITY / CONTENT AND SKILLS INDEX

	ART	MATH	READING	SCIENCE	SOCIAL STUDIES	WRITING
FIELD ACTIVITIES						
A Beach Study		●		●		
Beach Exploration		●	●	●		
Exploring the Pond Community				●		
Freshwater Marsh-Marsh Settlers				●	●	●
Freshwater Marsh-Marsh Succession				●		
Salt Marsh Discovery		●	●	●		●
Salt Marsh Field Study		●		●		●
CLASSROOM ACTIVITIES						
Clam Siphons				●		
Classifying				●		
Crossword Puzzle			●	●		●
Currents				●		●
Food Chain Connections				●		
Gyotaku	●					
Investigating Osmoregulation				●		
The Marine Aquarium		●		●		●
Marooned			●		●	
Observing the Living Crab		●		●		●
Open for Business		●				
Pickle Jar Ponds		●		●		●
Potato Fish				●		●
Rocks and Shells		●		●		

SOURCE: North Carolina Marine Education Manual, Connections

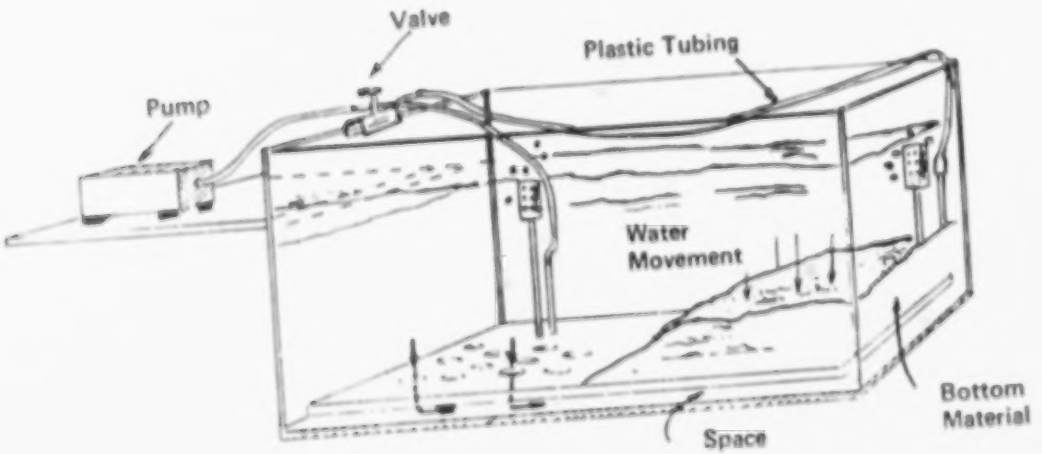
THE MARINE AQUARIUM

A marine aquarium takes more money, care and patience than a brackish aquarium system. However, you can teach about the sea from a classroom setting by having a marine aquarium. Living marine animals are fascinating to watch and they constantly demonstrate behavior and biological relationships. Then, the water in which sea animals live adjusts to environmental pressures. Many of the changes in sea water can be measured: salinity, pH, nitrate and phosphate, dissolved oxygen and temperature. Monitoring an aquarium is an interesting investigation in itself.

Setting up a marine aquarium requires an initial expense (or donation), care in its placement (not too close to the radiator, door, window) and regular maintenance once established. Students are usually interested in working with aquaria and can provide most of the maintenance and monitoring help. Your aquarium should be at least a 20-gallon tank. Some suggestions to aid and encourage you are given below.

a. Prepare the tank: Obtain an all-glass aquarium without a metal frame. Most marine organisms need a lot of water so be sure the aquarium will be big enough for your purposes. The usual size is between 10 and 30 gallons. Wash the aquarium with tap water and then rinse it with sea water.

b. Install the filter: Place an undergravel filter inside the aquarium and/or attach a pump-circulating filter to the outside of tne aquarium. The more water circulation you can provide the better. If you are using a box or outside filter, then you should also install an air stone to provide additional aeration.



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c. Add gravel substrate: Obtain a quantity of calcareous gravel about 5 mm (½" in diameter to buffer the pH of sea water and filter water). Crushed oyster shell can be bought from a feed/hardware store. If you are using an undergravel filter, the gravel will be placed on top of the filter and must not be small enough to fall through the openings in the filter. Enough gravel is needed to make a layer 5-7 cm (2" - 3") deep on the bottom of the aquarium. Rinse the gravel before using to remove any debris. Do not put any object into the tank that is made of metal.

d. Fill the tank with water: Obtain a supply of artificial sea water, e.g., "Instant Ocean." Very clean, settled sea water can be collected offshore or during a flood tide at an inlet, then held in the dark for 3 weeks. Place a pan or piece of paper on top of the sand in the aquarium to prevent the sand from being disturbed when the water is poured in. Fill the aquarium until the water level is about 2-3 cm (one inch) from the top of the tank. With magic marker, wax crayon or tape, mark the outside of the tank at the water level in order to check evaporation.

e. Install a glass cover and an aquarium light (optional): A glass cover will reduce water loss from evaporation and light will help you to see into the tank. The glass cover also prevents accidental trash (coins, gum, etc.) from being dropped into the tank.

f. To culture the filter, several methods are available; however, one of the surest is to obtain about a cup of gravel from a healthy marine aquarium that has been running for several months. Spread this "dirty" gravel over the gravel in your aquarium to inoculate it with beneficial bacteria. The bacteria are essential to the success of the aquarium. They utilize the waste products given off by the aquarium animals that if not removed would poison the animals. Add a few hardy animals such as crabs, lobster, groupers or sea bass to the aquarium so that as they are fed they will provide the filter with waste material to get it going. Do not feed them any more than what they will eat and remove any uneaten food. After about three weeks you should be able to begin replacing the hardy animals with more delicate species, but do not overcrowd the tank.

g. Avoid sharp changes in temperature, food or water. Remove about 1/3 of the water every six weeks, and add new sea water. Replace any water lost by evaporation (indicated by the water level sinking below the line you placed on tank in step (d) with fresh water.

h. Choose animals which are hardy and have good survival records in a classroom situation. These can be ordered from several biological supply companies or brought back from a beach trip (in aerated, cool jars).

1. Marsh minnows - mummichog, killifish and sheepshead minnow.
2. Small flounder, eels, rock bass or toadfish.
3. Starfish, sea anemones and sea cucumbers are usually very hardy.

4. Very small crabs (hermit, blue, mud) are useful to clean up scraps. Too large or too many crabs will destroy all the other life.

5. Most small snails do well. (Remember the "marsh periwinkle" - Littorina - breathes air.) Bivalves like clams, mussels, or oysters live reasonably well for short periods. Barnacles are an added bonus if you find some on oyster shells.

6. Avoid seaweeds, algae, and sponges in the tank as they don't survive and easily foul a tank.

i. Maintenance:

Daily

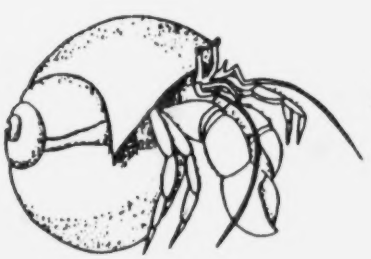
1. Check airlifts to ensure maximum water flow.
2. Make sure any accessories are operating correctly (heater, outside filter, light, etc.).
3. Check for any sick or dead fish.
4. When feeding, watch to see that most of the food is eaten.

Weekly

1. Check salinity and add fresh water to maintain initial water level.
2. Remove any salt accumulations on aquaria or accessories.

Monthly

Lightly stir gravel to stir up excess detritus, and siphon out ½ of the sea water. Replace with aged natural or freshly mixed artificial sea water of the same salinity and temperature as the water removed.



Hermit Crab (Pagurus)

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GRADE LEVELS: 5-12
CONTENT & SKILLS: science, math
SOURCE: Bellefield Nature Center

A BEACH STUDY - TEACHER'S GUIDE

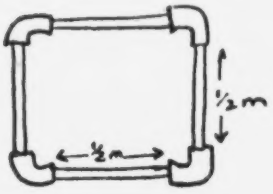
Introduction

This packet contains information for two separate activities that will help you plan a successful beach study. Also enclosed are student activity sheets, color-coded in blue, which can be copied for your students.

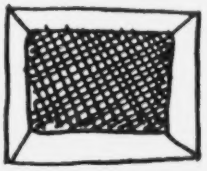
Teacher Preparation

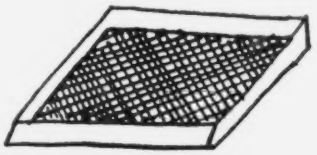
Beach studies can be scheduled for any season, although there is less activity and diversity in the winter. A successful study does not require a low tide; however, some narrow beaches will not be exposed enough during high tide.

This packet contains information and student activity sheets for two activities, "Making a Beach Profile" and "Beach Community Study". These are two separate but easily combined activities. Each activity lasts approximately 2-3 hours. The Student Activity Sheets list the objectives and needed equipment for each study. Most equipment is readily available. You may have to make some quadrats ($\frac{1}{4}m^2$) and sieve boxes for the Community Study. Quadrats can be easily made from flat pieces of wood or PVC pipes. Each side should be $\frac{1}{2}$ meter in length. Sieve boxes are merely screens stapled to a wooden frame or box. The frame box can be of any size.



Quadrat


Sieve Frame


Sieve Box

Student Preparation

Before your visit, prepare the students for the study by letting them know:

1. Where they are going - It is recommended that you visit and select an appropriate area for your study. Some considerations are access, length of beach, presence of dunes, and whether the site represents a "typical" beach.
2. What they will be doing - Describe the kinds of activities they will be doing at the site. You may want to review the student activity sheets and objectives.

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3. What they should wear and bring - Insects and sun may be a problem. If you sample at the water's edge, feet will get wet. It is important that the students and adult leaders be properly dressed and equipped so that they canparticipate in the field experience. Recommended clothes and supplies are:

   - old clothes
   - change of shoes if feet will be getting wet
   - rain gear, if rain is likely
   - insect repellent
   - sun screen and hats if sun-sensitive
   - worksheets and pencils

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A BEACH STUDY

At the Study Site for "Making a Beach Profile"

1. Divide the class into work groups of 4-5 students and distribute equipment.
2. Review the data sheet and field any questions. You may want to demonstrate the technique to the group. Remind the students that there will be no collection or destruction of any live plants or animals. Tell them to use care when walking around the dune plants.
3. Once everyone is clear about what they are to do, assign each group to a transect site. (If also doing the activity, "Beach Community Study", combine the study sites, and mark quadrat placement on the profile data sheet.) Have each group put a visible benchmark at the transect's end to keep the study straight. The starting point should be near the high tide line. Some student reminders:
   * Fill out only the first two columns of the data sheet. Cumulative values can be determined after the field study.
   * Carefully collect and record all data.
   * Pay special attention to + and - signs for elevation changes.
4. The recommended horizontal interval between meter sticks is 10 meters. Lengthen this for long, unchanging beaches, or shorten it to include special features. Have the groups measure this horizontal interval with the transect line on the ground.

Explain to the students that this measurement is not necessarily the value they record in Col. 2 - "Horizontal Distance". The value to be recorded is read from the transect line when the line is stretched tight between the meter sticks. For steep areas, this distance may be significantly different than the initial distance measured along the ground. See example #3 on the Student Activity Sheet.

After the Field Study for "Making a Beach Profile"

Follow-up activities maximize the field experience. Below are some suggestions.

1. Plot the beach profile. First, fill out cumulative calculations on the data sheet. These are horizontal and elevation measurements from the starting point. See example below.

Elev. Difference Col. 1	Horizontal Distance Col. 2	Cumulative Elevation Col. 3	Cumulative Distance Col. 4
+40 cm	9 m	+40 cm	9 m
+12 cm	10 m	+52 cm	19 m
-2.5 cm	8.5 m	+49.5cm	27.5 m

On graph paper, plot the elevation versus horizontal measurements to get a profile of the beach. Make sure any special observations are placed on the profile where they occurred. Indicate the water line.

2. Discuss or research these questions:

   * What physical and biological factors shape the beach features?

   * How do humans impact the beach?

   * What is the source of beach sand?

   * How might the beach change seasonally?

   * What is the importance of beaches?

3. Compare beach profiles of different sites or of the same site over time. How are these profiles different? What could have caused these changes?

A BEACH STUDY

At the Study Site for "Beach Community Study"

1. Divide the class into work groups of 4-5 students and distribute equipment.
2. Review the data sheet and field any questions.
3. Once everyone is clear about what they are to do, assign each group to a site to begin their study. Quadrat 1 should be near the high tide mark. (If also doing the activity, "Making a Beach Profile", combine the study sites, and mark quadrat placement on the profile data sheet.)
4. Remind the students that data should be carefully recorded and that zero is an important number. Stress that no live plants or animals will be collected or destroyed in the dunes. Have them be very careful to walk around the dune vegetation.
5. After each group has completely analyzed Quadrat 1, have them pace off or measure a distance (on the marked transect line) in a straight line towards the dunes. The next stop is Quadrat 2 on the data sheet.
6. Continue these procedures until everyone has analyzed the last sample site. You will want to visit each group to make sure they are following the procedures correctly and to help identify the plants and animals.
7. You may want to return to the water's edge and end with intertidal and subtidal sampling. This is Optional Stop 0 on the data sheet. (This sampling is not recommended as a beginning to the Community Study.)
8. Once everyone is finished, regroup to collect equipment. You may want to discuss some follow-up questions in the field or later in the classroom.

After the Field Study for "Beach Community Study"

Follow-up activities maximize the field experience. Below are some suggestions.

1. Use community study information to reconstruct a map of the beach site. (If a beach profile was graphed, place community data directly onto profile.)

Discuss:

* How did community structure change with distance from the water? What factors may have caused this?
* What role does vegetation play in the beach system?
* What could change the community structure?
* What stresses and adaptations are important to the success of beach inhabitants?

2. Compare this community structure with a different beach site, or the same beach over time.
3. If a beach seine was used, set up a salt water aquarium with collected organisms.

Making a Beach Profile
Student Activity Sheet

Introduction

In this activity you will follow a transect line (trans=across, sect=to cut) from the water's edge to the back dune area. You will work in groups of 4-5 students to make regular elevation and horizontal distance measurements along the transect. This information will later be graphed to provide a profile of the study beach.

Objectives

1. Measure elevation and horizontal distance changes along a beach transect.
2. Plot a beach profile using these measurements.
3. Infer shaping/controlling factors for the beach features.

Equipment (for each group)

visible benchmark (large stick or flagging material)

2 meter sticks

transect line - at least 10 meters long, marked off in 1 meter intervals

clipboard and pencil

data sheet - "Beach Profile Data Sheet"

line level

Procedures

Your group will begin its study at a designated spot along the water's edge. Place a visible benchmark at the transect's end as a reference point to keep the transect in a straight line.

1. Start transect measurements as close as possible to the water's edge. Place meter stick #1 at the starting point, and meter stick #2 10 meters away. Keep the transect line on the ground to measure this 10 meters.
2. Stretch the transect line between the two meter sticks, and attach the line level. Raise the line until it is horizontal (when the level's bubble is centered). The actual height does not matter, as long as the line is level.

   Keep the sticks vertical with the zero end touching the ground. If you need to push the sticks into the ground, make sure an equal portion of both is showing.
3. On each meter stick, read the height of the string. Subtract the reading of the meter stick furthest from the starting point

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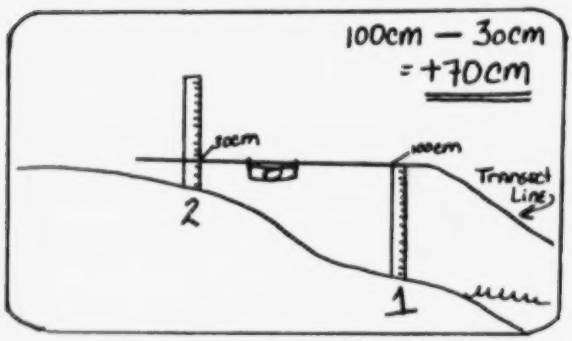
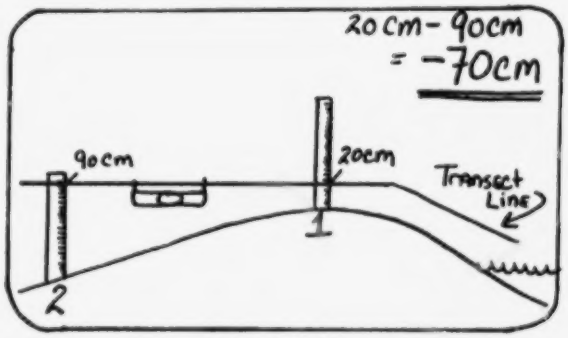
(stick #2) from the meter stick closest to the starting point (stick #1). This results in positive numbers for inclines and negative numbers for declines. See examples below. Record the difference in elevation in cm. in Col. 1 - "Elevation Changes". Don't forget the + or - sign!



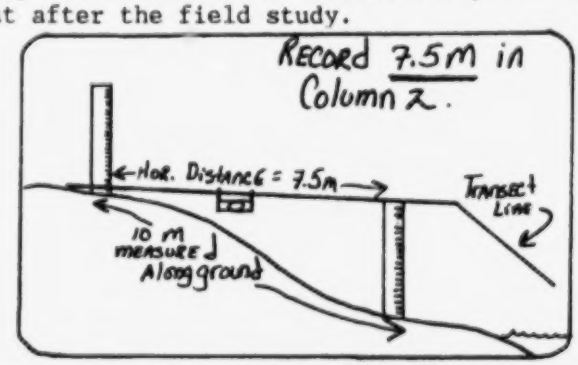
EX.1 Incline



EX.2 Decline

4. With the transect line still stretched between the two meter sticks, estimate in meters the horizontal distance. This may be different than 10 meters, especially if the ground is steep. See example #3. Record this distance in Col. 2 - "Horizontal Distance".

   Don't worry about cumulative calcuations yet. These can be filled out after the field study.



EX.3 Horizontal Distance

5. Record in Col. 5, "Comments", any special observations - strand line, start of plant life, wet sand, animal tracks, etc.

6. Move the starting point meter stick (stick #1) up to the position of the next meter stick (stick #2). Lower the transect line to the ground and move this second meter stick 10 meters along the line. Ten meters is only a recommended interval. Increase the distance for a long, unchanging beach. Shorten it to include any special features. Your teacher may help you decide on these intervals.

7. Repeat procedures for measuring elevation and horizontal distance changes until you reach the benchmark end-point.

   After the field study, transect information will be used to calculate cumulative measurements and to graph a profile of the beach.

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BEACH PROFILE DATA SHEET
Student Activity Sheet

Measured from mark to mark		Cumulative from starting point to mark		
Elevation Change (cm) 1	Horizontal Distance (meters) 2	Elevation Change - cm 3	Horizontal Distance -m 4	Comments 5
0	0	0	0	STARTING POINT

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Beach Community Study
Student Activity Guide

Introduction

In this activity you will work in groups of 4-5 students to describe plant and animal community changes moving along an environmental gradient from the backdune area to the water's edge.

Objectives

1. Identify common plants and animals.
2. Describe assemblages or "communities" of plants and animals.
3. Infer what factors may have caused the observed changes in community structures.

Equipment (for each group)

quadrat ($\frac{1}{4}m^2$)

data sheet - "Beach Community Description"

clipboard and pencil

transect line marked off in meters (optional)

seine

bucket

sieve box

shovels

Procedure

Your group will begin its study at a designated spot near the high tide mark. This is sample site or quadrat 1 on your data sheet. Once at this site you should:

1. Lay the quadrat down randomly.
2. Identify and count individuals of each animal species found.
3. Describe any animal signs.
4. Estimate total % coverage of <u>all</u> plant species.
5. Identify and count individuals of each plant species found.
6. Describe the sediment. Include in your description the moisture, texture, and color.
7. Include any other observations.
8. When you have completely described quadrat #1, your instructor will direct you to the next site moving towards the dunes. Repeat the procedures listed above for each site.
9. As an optional stop (Study Site 0), return to the water's edge to describe the intertidal and subtidal community. To best sample here, dig and screen for organisms. Use a seine if available.

BEACH COMMUNITY DESCRIPTION
Student Activity Guide

Quadrat#	1	2	3	4	5	6	OPTIONAL STOP 0
Location (m from water's edge)							
ANIMALS:							
mole crabs							
coquina clams							
polychaetes							
amphipods							
ghost crabs							
ant lions							
ants							
other							
other							
other							
other							
Animal Signs							
PLANTS:							
Total % Cover							
sea oats							
sea rocket							
pennywort							
beach bean							
beach elder							
sandspur							
aster							
other							
other							
other							
other							
SEDIMENT:							

GRADE LEVELS: K-5
CONTENT & SKILLS: science, math, reading
SOURCE: Bellefield Nature Center

BEACH EXPLORATION

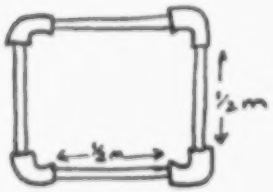
Introduction

Four different beach activities are described that will give students experience sorting, counting, collecting, observing, and identifying common beach inhabitants. Also included are data sheets, color-coded in blue, which can be copied for your students.

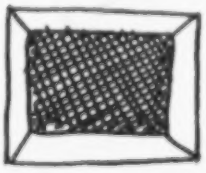
Teacher Preparation

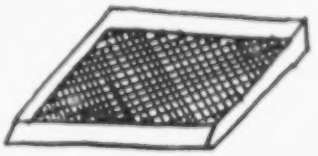
Beach studies can be scheduled for any season, although there is less activity and diversity in the winter. A successful beach study does not require a low tide; however, some narrow beaches will not be exposed enough at a high tide.

The activities described can be easily combined or kept separate. Each one lasts about 20 - 30 minutes. Equipment needed will depend on the specific activity. You will need something to limit sample size for the Community Study. Quadrats are easily made from flat pieces of wood or PVC pipes. Hula hoops, string circles, or coat hanger circles will also limit the sample size. To screen burrowing organisms during the Water's Edge Sampling, make sieve boxes by stapling screens to a wooden frame or box.



Quadrat


Sieve Frame


Sieve Box

Student preparation

Before your visit, prepare the students for the study by letting them know:

1. Where they are going - It is recommended that you visit and select an appropriate area for your study. Some considerations are access, length of beach, presence of dunes, and whether the site represents a "typical" beach.

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2. What they should wear and bring - Insects and sun may be a problem. If you sample at the water's edge, feet will get wet. It is important that the students and adult leaders be properly dressed and equipped so that they can participate in the field experience. Some recommended clothes and supplies:

   - old clothes
   - change of shoes if feet will be getting wet
   - rain gear, if rain is likely
   - insect repellant
   - sun screen or hats if sun-sensitive

3. What they will be doing - Describe the kinds of activities they will be doing at the site. Start the students brainstorming by asking them:

   - What is a community?
   - What might we find at the beach community?
   - Is the beach community easy to live in? Why or why not?
   - How do the plants and animals adapt to all those stresses?
   - How is the beach important?
   - How do we use the beach?

Activities at the Study Site

A. Beach Community Study

Equipment: data sheet - "Beach Community Study"

pencils

square quadrats, hula hoops, or anything to limit the sample size

In this activity, students record the plants, animals, and general characteristics of the beach community as they move in a straight line from the back dune area to the water's edge. Activity length is approximately 30 minutes.

1. Divide the class into groups of 4 - 5 students and distribute equipment to each group.
2. Place the groups in the back dune area and have them randomly drop quadrats. This is Stop 1 on the data sheet.
3. Ask the students to carefully observe the community within their quadrats and to search for the items listed on the data sheet. Check off the items found in Col 1. For plants, shells, burrows, etc., you may want to have the groups count and record the number of items present. Remind students to stay within the quadrat boundaries and to avoid walking on the vegetation.

4. After all the groups have completed Stop 1, move towards the water together to the next stop and repeat procedures. 5 - 6 stops are recommended for a complete study.

When finished with all stops, review the groups' findings. Draw a large beach profile and record the community study data on it. Ask the class:

- Do they see any community changes moving from the dunes to the water?
- Describe these changes.
- What might have caused the observed changes?

B. Water's Edge Sampling

Equipment: data sheet - "Sand Diggers"

pencils

seine

shovels

collecting jars or buckets

sieve boxes or screens to sift burrowing organisms

In this activity, students sample the intertidal and subtidal beach communities. Dress appropriately; feet will most likely get wet. Length of activity is about 30 minutes.

1. If a seine is available, use it with the entire class to collect subtidal critters. Make sure that you have a legal net or obtain a collecting permit from the SC Wildlife and Marine Resources Department.
2. To sample the intertidal, divide the class into small groups and distribute shovels and sieves. Place each group near the water's edge to collect sediment with hands or shovels, and screen it through a sieve to find burrowing organisms. Some common finds include mole crabs, coquina clams, polychaete worms, and amphipods. Record the name/type and number of organisms found on the data sheet in the first block (surf zone). Repeat this procedure at 4 different stops moving in a straight line away from the water. Make each stop about two giant steps (6 ft) apart.

Take a closer look at the subtidal and intertidal in the field or later in the classroom. Use microscopes or magnifying lenses if available. Ask the class:

- Are there any differences in your finds as you move away from the surf zone?
- What might have caused these changes?
- Would we find these animals back in the dunes? Why or why not?
- Do you think it is easy to live in the surf zone? Why or why not?

- How do these animals protect themselves from the waves?

- What do you think these animals feed on?

If you have a classroom aquarium, place the collected critters in it for long-term observation. You may also want to construct a food web using the organisms seen or collected at the beach.

C. Scavenger Hunt

Equipment: data sheet - "Scavenger Hunt"

jars or buckets

Divide the class into small groups, and if possible, assign an adult to each group. Distribute equipment to each group. Direct groups to find as many items listed as possible in a certain amount of time. After items are collected, findings can be shared among the whole group. Discuss the items, and ask the students to make comparisons and classifications. Bring the items into the classroom for display, mobile construction, or writing and drawing exercises.

D. Sensory Activities

Equipment: blindfolds

flash cards

The length of these activities varies from 10 - 20 minutes. Give one of the following a try or design your own. Sensory discoveries provide a nice complement to the more structured field studies. These are often most successful when they occur at the beginning of a field study.

1. Blindfold/Sighted Partners - Sighted student leads a "discovery" walk for the blindfolded partner.
2. Group Blindfold - Whole group walks from back dunes to water's edge gathering as much sensory information as possible.
3. Find-Me Cards - Look for different objects or conditions written on flash cards, ex. moist sand, smallest plant, coolest spot, crab hole, etc.

References

1. Calder, Dale R. and Margaret Callison Pridgen. Guide to Common Jellyfishes of South Carolina. Charleston, S.C.: South Carolina Sea Grant Consortium, 1977.

2. Gosner, Kenneth L. A Field Guide to the Atlantic Seashore From the Bay of Fundy to Cape Hatteras. Boston: Houghton Mifflin Co., 1978.

3. Porter, Hugh J. and Jim Tyler. Sea Shells Common to North Carolina. Raleigh, N.C.: NC Department of Natural and Economic Resources, Division of Marine Fisheries, 1971.

4. Spitsbergen, Judith. Seacoast Life: An Ecological Guide to Natural Seashore Communities in North Carolina. Raleigh NC: North Carolina State Mueum of Natural History, 1980.

5. Zim, Herbert S. and Lester Ingle. Seashores. New York: Golden Press, 1955.

BEACH COMMUNITY STUDY

(for use in Beach Exploration)

CAN YOU FIND...						
animal home?						
animal tracks?						
insects?						
sea shells?						
sea weed?						
sea oats?						
other beach plants?						
wet sand?						
dry sand?						
litter?						

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SAND DIGGERS

(for use in "Beach Exploration")

	Name of Animal	Number found
0' SURF ZONE		
6' 2 GIANT STEPS		
12'		
18'		
24'		

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SCAVENGER HUNT

(for use in Beach Exploration)

Items to find:

Seashells

1. Shell with ridges
2. Shell with a hole in it
3. Snail shell
4. Oyster shell
5. Pen shell
6. Find five shells that are different from the ones collected in items 1-5.

Other Items

7. Speckled crab shell
8. Crab claw
9. Shark's tooth
10. Sponge
11. Trash
12. Bird feather
13. Bone
14. Handful of sand
15-16. Find two different kinds of seaweeds.

GOOD LUCK !!

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GRADE LEVELS: K-6
CONTENT & SKILLS: science
SOURCE: Bellefield Nature Center

EXPLORING THE POND COMMUNITY

Introduction

This activity can be completed at almost any freshwater pond or lake. It gives students experience with sorting, counting, collecting, observing, and identifying common freshwater plants and animals. Don't be worried if you are not comfortable with the identification. Classifications like "white snail", "fish X", or "small round plant" are just as worthwhile as the actual names. Also, the reference guide listed is helpful and easy-to-use for identification. The activity usually lasts 30-60 minutes.

Teacher Preparation

Pond studies are most successful from spring through the fall. You will need the following equipment:

- dip nets, at least one for every 3-5 students
- collecting jars or buckets
- large plastic sheet, to sort through dipnetted material
- microscopes and/or magnifying lenses, optional

Student Preparation

Before your visit, prepare your students for the study by letting them know:

1. Where they are going - It is recommended that you visit and select an appropriate area for your study. Some considerations include proximity to school, stability of pond banks, and productivity of the pond.
2. What they should wear and bring - Insects and sun may be a problem. Recommended gear:
   - old clothes
   - rain gear, if rain is likely
   - insect repellent
   - sun screen or hats if sun-sensitive
3. What they will be doing - Describe the kinds of activities they will be doing at the site. Some suggested discussion questions:
   - What is a community?
   - What do you think is in the pond community?
   - What problems (stresses) might these animals have in the pond community?
   - How can they adapt to these stresses?

At the Study Site

1. Demonstrate proper collection procedures.
   - Use caution around pond edges.
   - Use a back and forth motion with the dipnet through the edge vegetation.
   - Take a dip into the bottom.
   - Dump out dipnetted materials onto plastic sheet
   - Put any live critters into jars or buckets.
2. Divide the class into small groups so that each group has one dipnet.
3. Groups should be able to sample at their own pace. Encourage the groups to dip into the bottom if the back and forth motion is unsuccessful. You may need to help students sort through their finds. Remember, many of these critters are small and easily overlooked.
4. Continue sampling until time or enthusiasm runs out.

After the Study

1. Observing
   Take a closer look at the collected organisms. Use microscopes or magnifying lenses if available. If not, macroscopic observations are just as good, and certainly easier. Direct the students' observations.
   Some suggestions:
   - Can you find the mouthparts?
   - What do you think this critter feeds on?
   - How does the animal move? Fast or slow? Swimmer or crawler?
   - Where do you think this critter might live in the pond? Bottom, top layer, around the edge vegetation, somewhere else?
2. Discussing
   Make a list of all plants and animals seen or collected at the pond.
   - What were the most common finds? (Maybe have students draw these)
   - What are some similarities among all the finds? Differences?
   - Would this pond community always look the same? What could change it?
   - Describe the pond bottom.
   - What are larval forms? Did we find any?
3. Food Web
   Using the list of organisms collected or observed, construct a food web. Give each student a 3 x 5 card, and have them write the name of a pond plant or animal on it. Pass around a ball of string to connect food/energy relationships between organisms. Students could also draw a food web. Questions:

- Who are the producers? Consumers? Scavengers?
- What could cause a whole group of organisms to die?
- What effect would that have on the food web?

4. Set up a freshwater aquarium with the collected plants and animals.
5. Compare the findings with another community, another pond, or the same pond at a later time.

References

Reid, George K. Pond Life. New York: Golden Press, 1967.
Includes good background information and an understandable field guide to common freshwater plants and animals.

GRADE LEVELS: 5-12
CONTENT & SKILLS: science, writing, social studies
SOURCE: USFWS, Freshwater Marsh Habitat Pac

FRESHWATER MARSH - MARSH SETTLERS

Purpose

In this activity students will take a field trip to investigate a freshwater marsh from the point of view of pioneers settling the area. Students will learn about food webs and their place in them. They will evaluate the marsh as a source of food and shelter.

Learning Outcomes

After completing this activity, the students will be able to:

A. Identify the values of the marsh to humans.

B. List two reasons why settlers might not want to live near a marsh.

C. Draw a food web containing at least five elements of which the student is one.

D. Name two marsh plants that pioneers might have used for food.

Organization

Who: Groups of 5 to 6

Where: Freshwater marsh

When: Spring, summer, or fall

Time: 1 to 2 hours

Safety: A. This activity takes place near open water. Where the water is deep, identify the nonswimmers; organize the class in a buddy system for water safety. There should be at least one adult for every 10 students.

B. Wild food plants: Students must not eat any plants they find as potential wild food sources.

Materials: For the Group

- Guides to edible wild plants
- Freshwater marsh field guides
- Insect repellent

Materials: For Each Student

- Student Data Sheets and pencil
- Clipboard (Masonite or stiff cardboard with a paper clip or binder clip)

Directions

1. Introduce the concept of the food web. Discuss different animals and what they eat. Stress the role of plants as the primary producers.

   Give examples of marsh plants as food (Consult a food guide, see references). Name some common ones that the students are very likely to see in the marsh.

   Examples:

   Cattails - muskrats eat leaves, stems, and roots and use them for building their lodges; humans eat the stems and flowers.

   Arrowheads - ducks and humans eat the tubers.

   Bulrushes - ducks eat the seeds; humans and muskrats eat the roots.

2. Distribute student materials and caution the students to be careful around the marsh, especially near open water. (Review safety procedures.)

3. At the site, the students are to imagine they are pioneers who have chosen to settle near a marsh because of the food and other resources available there. They will evaluate places to build cabins and find food sources.

4. Assign each group a "cabin site" to evaluate, using the student data sheets. Try to choose sites that are different (e.g. one in a low spot; one in the nearby woods; one on a point of land).

5. After evaluating their cabin sites, students should look for things the pioneers might have eaten and list them on their data sheets. If they can't decide whether something is edible, ask them how they think the pioneers would have found out (eat some; ask the Indians; compare it with similar plants they used in their home countries). You might take on the role of an advising Indian by using the food guide. After the students record what pioneers would eat, they should also record how these plants and animals get their food.

   Caution: Students must be warned not to eat any plants they find on their field trip.

Yellow pollen: mix with pancake flour
Green flowers cook like broccoli
New sprouts boil or roast
Roots: grind into fine, white flour
Cattail

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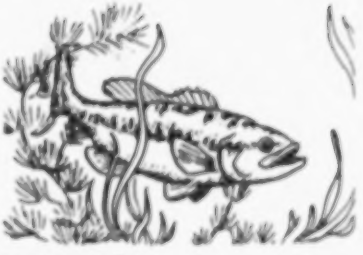
6. Gather students together. Each group should discuss the pros and cons of their various building sites and tell what they found to eat. As they were sampling for food in the marsh, the students probably noticed other creatures (namely insect) trying to eat them. The insects have been annoying to the students, but they are important in the marsh food web. How many of the animals the students found depend on insects for food? (Many - including some species of fish, frogs, turtles, birds, and other species)

Great Blue Heron

Leopard Frog



Largemouth Bass

Follow-up

Students used insect repellent to avoid insect bites. What could early settlers (and other animals) do to avoid insects? (Stay in breezy places; go into the water; use "natural" insect repellents, e.g. pennyroyal mint.)

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References

1. Gibbons, Euell. Stalking the Wild Asparagus. N.Y.: McKay Co. Inc., 1962. (food guide)

2. Medsger, Oliver P. Edible Wild Plants. N.Y.: MacMillian Co., 1962. (food guide)

3. Reid, George, K. Pond Life. N.Y.: Golden Press, 1967.

4. Ursin, Michael, J. Life In and Around Freshwater Marshes. N.Y.: Thomas Y. Crowell Co., 1973. (field guide)

Quiz Answers

1. 1 - c; 2 - d; 3 - b; 4 - a.
2. Possible answers:
   - Biting insects
   - Keeping farm animals out of the marsh.
   - Biting insects
3. Some ways of finding edible things are better than others; in the marsh there are several possibilities.

   The pioneers could have:
   - Asked the natives (Indians)
   - Checked a book (not available to the very first explorers, but plants were recorded very early)
   - Found out by trial-and-error (sometimes the errors had dire results)
   - Watched what animals ate (not always an accurate indicator for humans)
   - Searched for things that looked similar to what they ate in their native countries before they came to America.
4. Any marsh plant or animal is a valid element of the web. If a student has connected things in a way that seems unlikely, check your field guide.

Freshwater Marsh Lesson Plan 2 Quiz

Name:

1. Draw lines to match the things found in the marsh (Column A) with their values to people (Column B).

A.	B.
1. Fish	a. Baskets
2. Marsh creeks	b. Furs
3. Beavers	c. Food
4. Reeds	d. Water supply

2. Pioneers lived near marshes for many reasons. What are two problems they had to deal with when settling there?

a. _____

_____

b. _____

_____

3. If you were a pioneer settling in a new area, how would you find out what to eat? Can you list two ways?

a. _____

_____

b. _____

_____

4. Draw a food web with at least five animals or plants. Include yourself as one of the animals. You can use either pictures or names. Be sure to draw arrows to show who eats whom.

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Department of the Interior/U.S. Fish and Wildlife Service, 1980

Name:

Name or describe 7 things in the marsh that pioneers might have eaten. Can you find these things in this area? Are there many or only a few of each? How do these things get their food?

Something a Pioneer would eat:	Are there many or few?	How does it get its food?
1.		
2.		
3.		
4.		
5.		
6.		
7.		

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Department of the Interior/U.S. Fish and Wildlife Service, 1980

Freshwater Marsh **Lesson Plan 2** **Data Sheet**

Name:

Cabin Site #	Yes	No
1. Is the soil firm?		
2. Will the site flood in the spring? (What if a beaver builds a dam in the creek nearby?)		
3. Will your farm animals wander onto soft ground and become trapped in mud?		
4. Are there building materials nearby?		
5. Is there transportation nearby? (A creek, maybe.)		
6. Is water easily available and safe to drink? (Remember you have to carry it in buckets.)		
7. Can you get food easily?		
8. Will bugs be a problem? (Will there be a lot of them around? More than in other places? Will you have a breeze to keep them away?)		
9. Will winter winds be too cold?		
10. Would you build your cabin here?		

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GRADE LEVELS: 5-12
CONTENT & SKILLS: science
SOURCE: USFWS, Freshwater Marsh Habitat Pack

FRESHWATER MARSH - MARSH SUCCESSION

Purpose

This activity helps students become familiar with some of the organisms that live in the marsh and with the gradual succession of marshes into dry land.

Learning Outcomes

After completing this activity, the students will be able to:

A. Arrange several pictures or descriptions of different stages of marsh succession in the correct time sequence.

B. Indicate on an attitude scale how they feel about management of marshes.

C. Construct a transect sample of a habitat.

Organization

Who: Groups of 3 or 4

Where: Freshwater marsh

When: Any season- spring is preferred

Time: 1 to 2 hours

Safety: This activity takes place near open water: Caution students not to go far into open water; add snake warning if appropriate for your area.

Materials: For Each Group

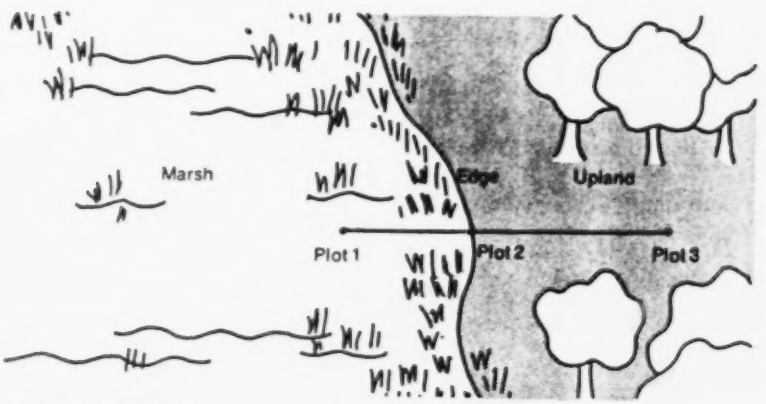
- Pond guide (1 per group, if possible)
- Insect repellent
- String, 7 meters (20 feet)
- Scraper (cup)
- White pan or tray
- Magnifying glass or hand lens (optional)

Materials: For Each Student

- Student Data Sheet
- Pencil
- Clipboard (Masonite or stiff cardboard with a paper clip or binder clip)

Directions

1. In the classroom, introduce the concept of succession.
2. For the field trip, make sure students dress properly. They will get their feet wet, so they should wear boots or change into old sneakers that can get muddy. Form students into groups and distribute all materials to each group.
3. At the marsh, go over safety precautions.
4. Instruct each group of students to establish a transect line at the edge of the marsh, using the 7-meter (20-ft) string. One end of the string should be staked 1 to 2 meters (3-6 ft) inside the marsh depending on water depth. The other end should be staked on dry land. The line should be at right angles (90°) to the marsh edge, as shown in the diagram.
5. Three sample plots of clipboard size should be taken along this line: plot #1 - 1 to 2 m (3-6 ft) inside marsh; plot #2 - at marsh border; plot # 3 - at the upland end of the line. The plots need not be equidistant.
6. Students should define the area of their sample plots by holding their clipboards over the ground or water next to the appropriate points on the line and marking the corners with sticks.



Transect Line Diagram

7. Students should then look for all the different kinds of organisms - both plants and animals - they can find within the plot. Be sure they check plant leaves and look under rocks. Along one edge they should collect 2 to 3 cm (about 1 in) of soil, spread it in the tray, and check carefully for living things. On the Data Sheets, students should identify the organisms - describe, name (using the pond guide), or draw them - and record the numbers of each and where found (e.g. on a leaf, under the soil).

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After they look for organisms in the soil, the students should examine the soil itself. What is its texture - fine or coarse? Is it wet or dry? What does it seem to be made of? Allow 20 to 30 minutes for each of three plots.

8. After the students complete each sample, they should replace all rocks and logs before going to their next plot. Through discussion, point out that the habitat should be returned as nearly as possible to its natural state so that the organisms living there may survive.

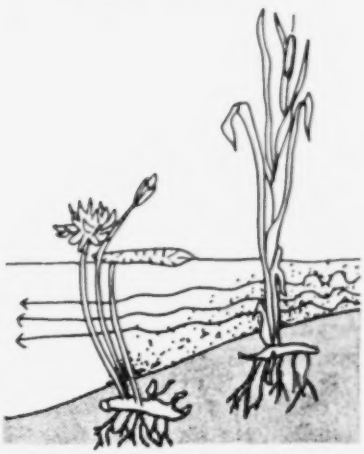
9. Gather the students together to discuss their findings. What kinds of organisms did they find in each plot? Were the organisms very similar? How were their habitats different? What signs were there that succession is actually occurring?

   Discuss differences in soil among the plots. The soft soil being accumulated among the waterlilies, cattails, rushes, or sedges is the buildup of dead plant material and soil washed in from the surrounding area. What will happen as this buildup continues? How do marshes change with time? (In some cases, the buildup of soil and plant material will slowly fill the marsh.

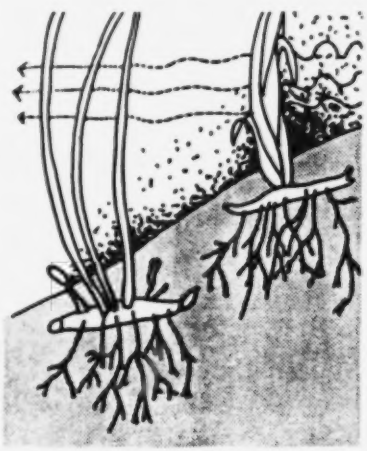
Followup

Now that the students have seen the natural process of change in a marsh, discuss some of the changes that can be induced by human activities and management. What would happen if development in the surrounding areas increased the amount of soil being washed into the marsh? (Increased sedimentation would cause the marsh to fill faster.) What would happen if the water level were raised? (Some plants would die and the marsh would be opened up.) Discuss how such changes affect wildlife in the marsh. (Higher water levels might open up the marsh and provide better habitat for waterfowl. However, the loss of vegetation might reduce muskrat populations since they would have less food.)

Soil-building Process in the Marsh



a. Water carrying eroded soil is slowed as it flows through heavily rooted bases of cattails and waterlilies.



b. Soil settles out around plant roots.

c. Dead plant material falling into the water also builds soil.

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References

1. Klots, Elsie, B. The New Field Book of Freshwater Life. N.Y.: GP Putnam's Sons, 1966.

2. Marshall, Alexandra. Still Waters. N.Y.: William Morrow & Co., Inc., 1978.

3. Niering, William, J. The Life of the Marsh. N.Y.: McGraw Hill, 1966.

4. Our Nation's Wetlands. Council on Environmental Quality. Washington, D.C.: Government Printing Office, 1978.

5. Reid, George, K. Pond Life. N.Y.: Golden Press, 1967.

6. Ursin, Michael, J. Life In and Around Freshwater Marshes. N.Y.: Thomas Y. Crowell Co., 1975.

Films

1. Cry of the Marsh. N.Y.: A.C.I. Films, 1969

2. The Everglades. Washington, D.C.: National Geographic Filmstrip, 1972.

3. One Day at Teton Marsh. Burbank, California: Walt Disney Productions, 1966.

Quiz Answers

1. The correct sequence is: B - C - A. Usually, as a marsh grows older, it fills in and becomes drier. There is progressively more emerging vegetation and less open water.

2. The students' drawings should be similar to the one in the lesson plan. The transect line should cut through the different habitat zones. One sample plot should be drawn in each zone. In this way the sampling will show different types of habitats and of marsh organisms.

3. There is no correct answer for this question. Student answers can be used to develop a class discussion on the values of marshes. How are marshes manipulated (managed)? What are some values and/or problems associated with that manipulation?

4. Upland habitat: A - tree(red oak); F - earthworm.
   Marsh habitat: B - cattail; C - turtle (Western painted turtle); D - bullfrog: E - muskrat

Freshwater Marsh Lesson Plan 1 Quiz

Name:

1. These pictures show a marsh growing older in three stages.

a.

b.

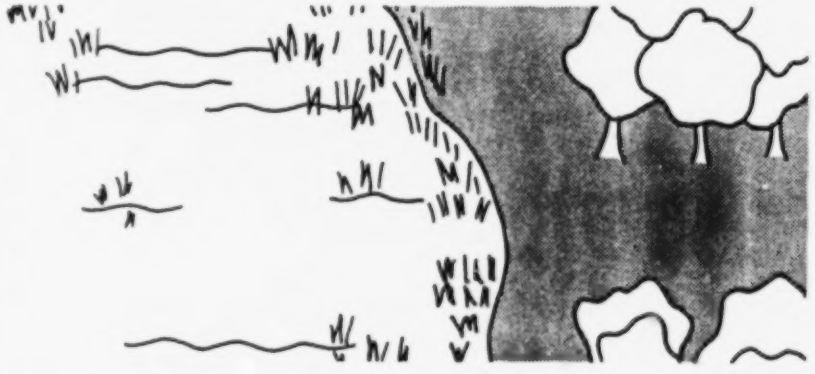
c.

Which one would you see first? _____

Which one would you see next? _____

Which one would you see last? _____

2. How would you take a transect sample of this area? Draw in your sampling line.



3. Do you think that marshes should be left alone for natural succession? Or, do you think that people should control succession in marshes?

Put an X in the box that shows how you feel.

All marshes should be left alone.	Succession should be controlled only in marshes that are affected by people's actions (increased erosion or fertilizer).	Succession should be controlled in marshes wherever this control might increase wildlife populations.	Succession should be controlled in marshes wherever possible.

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Name:

4. These pictures **A, B, C, D, E,** and **F** are of plants and animals found in or near a marsh.

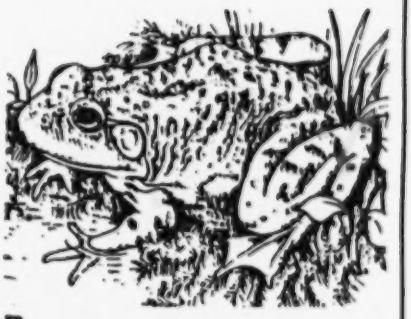
Which ones would you expect to find ***in the marsh habitat?***
Which ones would you expect to find ***in the upland habitat?***

Write MARSH or UPLAND under each picture.

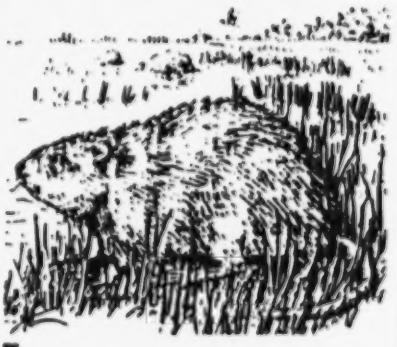
A

B

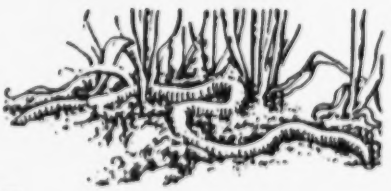
C



D



E



F

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Department of the Interior/U.S. Fish and Wildlife Service, 1980

Plot 1 Marsh	Soil (color, moisture, texture)		Plot 2 Edge	Soil (color, moisture, texture)		Plot 3 Upland	Soil (color, moisture, texture)	
Organism (Plant or animal)	Number Found	Where Found	Organism (Plant or animal)	Number Found	Where Found	Organism (Plant or animal)	Number Found	Where Found

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Name:

Department of the Interior/U.S. Fish and Wildlife Service, 1980

GRADE LEVELS: K-4
CONTENT & SKILLS: science, reading, writing, math
SOURCE: Bellefield Nature Center

SALT MARSH DISCOVERY

Introduction

This guide has been designed to help you plan a successful salt marsh field study. Two activities are included which will give students experience with sorting, collecting, observing, and identifying common salt marsh plants and animals. Also included are student activity sheets, color-coded in blue, which can be copied for your students.

Teacher Preparation

It is best to schedule a salt marsh study at or near low tide. The marsh surface is exposed at low tide, and plants and animals can be readily observed. Time of year is also important; fall and spring are excellent periods for salt marsh studies.

"Sensing the Sea" lasts about 10-15 minutes, and is a good introduction to "Salt Marsh Habitat Study" (length = 30-40 minutes). Equipment is minimal; only data sheets, pencils, and collecting jars or buckets are needed.

Student Preparation

Before your visit, prepare the students for the study by letting them know:

1. Where they are going - It is recommended that you visit and select an appropriate area for your study. Some considerations are access, safety, and whether the site is a typical salt marsh.
2. What they should wear and bring - Salt marshes are both wet and muddy. Insects are also abundant at times during the year. It is important that students and adult leaders be properly dressed and equipped so that they can participate in the field experience. Recommended clothes and supplies are
   - old clothes (long pants, preferably)
   - old sneakers or rubber boots (& change of shoes for a long ride home)
   - rain gear, if rain is likely
   - insect repellant
   - sun screen and hats, if sun-sensitive
   - worksheets and pencils
3. What they will be doing - Describe the kinds of activities they will be doing at the site. Start the students brainstorming by asking them:

- Has anyone ever been to a salt marsh before?
- What might we find in the salt marsh community?
- Do you think salt marshes are important? Why or why not?

Other Preparation Activities

- Pull any new vocabulary words from the data sheet and go over definitions and pronunciations with the class.
- View the film, "The Thin Green Line". (See Resource List).

Activities at the Study Site

A. Sensing the Salt Marsh

Equipment: Data sheet - "Sensing the Salt Marsh"

pencil

In this activity, students will use all their senses to answer the questions on the data sheet. Calm and quiet the group as much as possible before beginning this activity. Spread out the students to encourage individual and quiet work. Tell them:

1. Take their time.
2. There are no "wrong" answers; answer what they think is right.
3. No talking until everyone is finished.
4. No one will have to share their answers.

Questions # 1-5 are answered looking out at the marsh; the remaining questions are answered from along the marsh edge.

Note: Young groups may not be able to read the data sheet. Gather the group closer to you, and quietly ask the questions.

B. Salt Marsh Habitat Study

Equipment: data sheet - "Habitat Study"

pencils

collecting jars or buckets

dip nets

seine

1. Divide the class into groups so that each group has an adult leader.
2. Distribute the equipment to each group.
3. Explain to the students that they will be making four different stops in the marsh, and each stop represents a different habitat. At each stop have them stay with their group leader and try to find the marsh plants and animals listed on the data sheet. Check off the plants and animals as you find them in each habitat. You may want to have the class count and find as many as they can of each species. Each group can collect one of each type of animal. Tell the students that they are not to pick any plants.

Note: At the water stop, pull a seine if available. Make sure the net is a legal size, or obtain a collecting permit from SC Wildlife and Marine Resources Department. Dip nets can also be used here to sample the water habitat. If none of this sampling equipment is available, have the students guess about what they <u>think</u> is in the water habitat.

When finished with all four stops, bring the entire group back together to share their findings. Discuss habitat observations and look at animals collected. Some possible questions are:

* Were all the stops the same?
* How were they different?
* Were there any animals found at every stop? (identify and pass around)
* What animals were found . . .
    - in the water?
    - in the short cordgrass?
    - in the tall cordgrass? identify and pass around
    - under the detritus?
* What do you think they feed on? Who eats them?

<u>Printed Resources</u>

1. Gosner, Kenneth L. <u>A Field Guide to the Atlantic Seashore From the Bay of Fundy to Cape Hatteras</u>. Boston: Houghton Mifflin Co., 1978.

2. Gosselink, James. <u>Tidal Marshes: The Boundary Between Land and Ocean</u>. U.S. Fish and Wildlife Service, Office of Biological Services, FWS/OBS - 80/15.

3. Spitsbergen, Judith. <u>Seacoast Life: An Ecological Guide to Natural Seashore Communities of North Carolina</u>. Raleigh, NC: North Carolina State Museum of Natural History, 1980.

4. Teal, John M. and Mildred Teal. <u>Life and Death in the Salt Marsh</u>. NY: Ballantine Books, 1969.

<u>Films</u>

1. <u>The Thin Green Line</u> - Available from SC Wildlife and Marine Resources Dept., Film Library, P.O. Box 167, Columbia, SC 29202, 758-8291.

Sensing the Salt Marsh

Name: _____

1. Is all of the marsh grass the same height?

3. Does all of the marsh grass look the same color?

3. How many different plants do you see?

4. Do you see any animals in the marsh? How many?

5. Name three (3) sounds that you hear.

   Are any of these sounds made by people?

   Raise your hand when you are finished. The leader will direct you to the next spot.

6. Rub your fingers along the edge of the grass. How does it feel?

7. Do you see any plants that you didn't see before?

8. Do you see any different animals?

9. Pick up a small amount of soil. How does it feel?

   How does it smell?

Complete these statements about the marsh.

I wonder _____

_____ .

I wonder _____

_____ .

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HABITAT STUDY

HABITATS

Can you find ...	in the water	under the detritus	with the tall cordgrass	with the short cordgrass
CORDGRASS				
PICKLE PLANT				
NEEDLERUSH				
FIDDLER CRAB				
PERIWINKLE SNAIL				
SALT MARSH SNAIL				
RIBBED MUSSEL				
OYSTER				
SAND HOPPER				
GRASS SHRIMP				
MINNOW				
BIRDS				
OTHER				
OTHER				
OTHER				

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GRADE LEVELS: 5-12
CONTENT & SKILLS: science, math, writing
SOURCE: Bellefield Nature Center

SALT MARSH FIELD STUDY

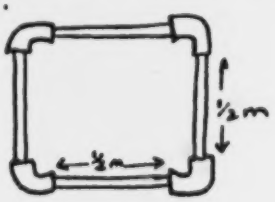
Teacher's Guide

Introduction

A well-planned visit to a salt marsh can be a very worthwhile experience for you and your students. Some suggestions are made in this section to help you plan an effective study. Also enclosed with this packet are student activity sheets (color-coded in blue) which can be copied for your students.

Teacher Preparation

It is best to schedule a salt marsh study at or near low tide. The marsh surface is exposed at low tide and plants and animals can be readily observed. Time of year is also important. Fall and spring are excellent periods for salt marsh studies. Enclosed is the student activity sheet, "Salt Marsh Communities". Listed are the objectives and the equipment needed for the study. Most of the equipment is readily available. However, you may have to make some quadrats ($\frac{1}{4}m^2$). These can be easily made from flat pieces of wood or pvc pipe. Each side should be $\frac{1}{2}m$ in length (see picture below). The community study lasts approximately 2 hours.



Quadrat

Student Preparation

Before your visit, prepare the students for the study by letting them know:

1. Where they are going - It is recommended that you visit and select an appropriate area for your study. Some considerations are access, safety and whether the site is a typical salt marsh. Describe the site and its location to your students.
2. What they will be doing - Describe the kinds of activities they will be doing at the site. You may want to review the student activity sheet and objectives.
3. What they should wear and bring - Salt marshes are both wet and muddy. Insects are also abundant at times during the year. It is important that students and adult leaders be properly dressed and equipped so that they can participate in the field experience. Recommended clothes and supplies are:

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- old clothes (long pants, preferably)
- old sneakers or rubber boots (& change of shoes for a long ride back)
- rain gear, if rain is likely
- insect repellent
- sun screen & hats, if sun-sensitive
- worksheets and pencils

Also, provide your students with some background information on salt marshes. Some recommended preparation activities are:

1. Review the vocabulary words included with this packet.
2. Copy and hand out the study questions. Tell your students that they should be able to answer these after they complete the study.
3. Discuss the nature and importance of salt marshes.

<u>At the Study Site</u>

1. Divide the class into work groups of 4-5 students and distribute equipment.
2. Review the data sheet and answer any questions.
3. Once everyone is clear about what they are to do, assign each group a site to begin their study (Quadrat 1 along marsh-creek edge).
4. After each group has completely analyzed site 1, have them measure a distance in a straight line toward the upland edge of the marsh. The next stop is Quadrat 2 on the data sheet.
5. Continue these procedures until everyone has analyzed the last sample site. You will want to visit each group to make sure they are following the procedures correctly and to help identify and point out the plants and animals.
6. Once everyone has finished, regroup and discuss the data and organisms observed. Possible discussion questions include:
   - Where was the cordgrass tallest, shortest? Why?
   - What plant was the most abundant?
   - Which quadrat had the most different types of plants? Why?
   - What animals did you observe and where?
   - What do you think these animals eat?
   - What eats them?
7. Gather up all live organisms collected and return to their habitats in the marsh.
8. If time, equipment and site permits, it is always fun and educational to sample the creek with a seine net. If you decide to include this in your study, make sure you have a legal net or a collecting permit from the South Carolina Wildlife and Marine Resources Department. Also, make sure the water is not too deep and it is safe from razor-sharp oysters.

After the Field Study

In order to maximize the benefits of the field experience, it is recommended that you follow the study with activities back in the classroom. Several suggestions are made below that should enhance the learning experience for your students:

1. Use the data collected during the study to reconstruct a map of the marsh.
2. Have the students complete the study questions and discuss the answers.
3. Reconstruct a salt marsh food web using all of the organisms seen during the study. This can be done individually or as a group. A fun way to demonstrate the food web concept is to have the students represent the plants and animals and use string to connect them to what they eat. Once the food web is constructed, discuss what would happen if certain members were killed by pollution.
4. Have students research marsh organisms of their choice and prepare a report.
5. Set up a salt water aquarium to stimulate further interest. An aquarium can be an excellent starting point for activities from all subject areas.
6. Compare the salt marsh to other ecosystems: a freshwater pond, brackish marsh, or an area around your local school.
7. Research and discuss local, state and federal regulations concerning wetlands.
8. Develop a simulation game for a proposed salt marsh development such as a condominium/marina complex. Divide the class into 2-3 special interest groups (developers, fishermen, landowners, etc.) and have them support or reject the proposal. They must be prepared to defend their decision and respond to questions from other groups. Possibly a separate judging party could decide the issue.

References

1. Gosner, Kenneth L. A Field Guide to the Atlantic Seashore from the Bay of Fundy to Cape Hatteras. Boston: Houghton Mifflin Co., 1978.

2. Gosselink, James. Tidal Marshes - The Boundary Between Land and Ocean. Washington: U.S. Fish and Wildlife Service, Publication No: FWS/OBS-80/15, July 1980.
For more information contact:
Information Transfer Specialist
National Coastal Ecosystems Team
U.S. Fish and Wildlife Service
NASA - Slidell Computer Complex
1010 Gause Blvd.
Slidell, LA 70458

3. Spitsbergen, Judith. Seacoast Life: An Ecological Guide to Natural Seashore Communities in North Carolina. Raleigh, NC: NC State Museum of Natural History, 1980.

4. Teal, John and Mildred. Life and Death of the Salt Marsh. New York, NY: Ballantine Books, 1969.

SALT MARSH STUDY VOCABULARY LIST

Estuary - A semi-enclosed body of water which is connected to the sea. It is an area where freshwater from land drainage mixes with sea water from the ocean. Examples: Delaware Bay, Chesapeake Bay, Winyah Bay in SC

Salt Marsh - The wetlands in an estuary typically covered by salt-tolerant plants.

Ecology - The study of the relationships between organisms and their environment.

Food Chain - The transfer of food energy from one organism to another. All food chains begin with organisms that can manufacture their own food (producers). Plants are producers and use the energy from the sun to make their own food. Organisms that cannot make their own food and rely on other organisms for food are known as consumers.

Food Web - Several interacting food chains. Feeding relationships in nature tend to be complex and organisms typically feed on a variety of food sources. Hence, when all food relationships are linked in a diagram, it looks like a web.

Detritus - Dead plant matter and associated microorganisms. Detritus is the base of the salt marsh food web.

Habitat - The place where an organism lives.

Tides - The regular rising and falling of coastal waters in response to the gravitational pull of the moon and sun. In South Carolina the tides are known as semi-diurnal which means we experience 2 high tides and 2 low tides over a 24 hour cycle.

Salinity - The amount of dissolved salts in water. It is commonly expressed in parts per thousand (o/oo) - Ocean water is approximately 35 o/oo or 35 parts salt to 1,000 parts water.

Community - All the interacting plant and animal populations in a common area.

Succession - Changes in community structure over time in response to changing environmental factors.

Ecosystem - All the living and non-living things interacting in a defined area.

Salt Marsh Communities - Student Activity Sheet

Introduction

In this activity you will work in a group of 4-5 people and study and record information on marsh plants and animals. Each group will receive the equipment listed below. Your instructor will tell you where you should begin the study.

Objectives

During this activity you will:

1. Identify common plants and animals in a marsh
2. Describe assemblages or "communities" of marsh plants and animals
3. Infer what factors might cause the observed changes in community structure.

Equipment (For each group)

quadrat ($\frac{1}{4}$ m^2)

meter stick

sample jar

clipboard & pencil

data sheet

Procedures

Your group will begin its study at a designated spot along the edge of the marsh creek. This is sample site or quadrat 1 on your data sheet. Once at this site you should:

1. Lay the quadrat down randomly.
2. Identify and count all plants and record the information under column 1 on your data sheet.
3. Identify and count all animals and record the information. If no crabs can be seen on the marsh surface, count fiddler crab burrows and record these.
4. Measure the height of the cordgrass.
5. Describe the soil (texture, moisture content, color, odor, etc.)
6. Place a representative of each of the live animals you observe in your jar. Please do not pick any plants and remember, we only need <u>one</u> sample of each type of animal.

When you have completely described quadrat 1, your instructor will direct you to the next site. Repeat the procedures listed above for each site. When everyone is finished, we will share our results, discuss the live animals and return them to the marsh.

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SALT MARSH COMMUNITITIES

Date:_____ Time:_____

Place:_____

QUADRATS

	1	2	3	4	5
	Distance from Water's edge: 0 M.	Distance:____	Distance:____	Distance:____	Distance:____
PLANTS					
Cordgrass	Ht:	Ht:	Ht:	Ht:	Ht:
Seaweed					
Pickle Plant					
Sea Oxeye					
Needle Rush					
Marsh Elder					
Groundsel Bush					
Other(s)					
ANIMALS					
Fiddler Crabs					
Square-back Crabs					
Ribbed Mussels					
Periwinkles					
Salt Marsh Snails					
Amphipods					
Other(s)					
SEDIMENT DESCRIPTION					

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SALT MARSH STUDY QUESTIONS

Name: _____

1. Describe an estuary.

2. List three plants that live in salt marshes.

3. List five animals that live in salt marshes.

4. Which quadrat in your study had the greatest diversity of plants? Explain what might have caused this.

5. What is a community?

6. Describe the different marsh communities that you saw.

7. What do you think may have caused these community changes?

8. What is detritus and why is it important?

9. List 3 reasons why salt marshes are important.

10. List 3 salt marsh animals that people like to eat.

11. Do you think salt marshes should be protected? Why or why not?

12. Are salt marshes protected in South Carolina? If yes, how?

13. List three ways people use salt marshes.

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GRADE LEVELS: K-4
CONTENT & SKILLS: science
SOURCE: Project CAPE, A Sea Creature Treasury

CLAM SIPHONS

LESSON CONCEPT

A clam has two siphons; one lets water pass in and the other lets water pass out.

COMPETENCY GOALS

1. The learner will demonstrate the ability to observe.
2. The learner will demonstrate the ability to experiment.

OBJECTIVES

1. The learner will observe a clam to see the siphons and how they function.
2. The learner will draw a picture of the clam showing how the water passes in and out of the siphons.

MATERIALS

plastic container (food container)
food coloring
clam
natural sea water or salt water
synthetic sea salts for making salt water
(follow directions on package)

synthetic sea salts are available from:
Carolina Biological Supply
Raleigh, NC 27215

BACKGROUND INFORMATION

Water enters and leaves the clam through its siphons. A clam has two siphons. One siphon lets water come in. This water carries oxygen and food. The water passes over the gills and provides oxygen for the clam. The old water is expelled through the other siphon. Waste products are carried out with the water.

TEACHER PREPARATION

Obtain a live clam from the sound or ocean. Place the clam in a plastic container of natural sea water or synthetic sea water.

ACTIVITIES

1. CLAM SIPHONS

   a. Place enough sea water in the plastic container to cover the clam.

   b. Allow the clam to relax. It will extend its siphons.

   c. Partially fill a bottle with sea water and then add 2-4 drops of food coloring to the water in the bottle. Shake to mix.

   d. Very carefully place a drop of the colored water near the siphons and observe the results.

   e. Be careful not to add too much of the colored water or the results will be masked.

   f. Keep adding drops if needed. Observe the "pulling in" of the water and the "shooting out" of the water.

   g. Ask the students to draw a picture of the clam indicating the flow pattern of the water through the siphons.

REFERENCE

Outdoor Biology Instructional Strategies. "Water Breathers." Lawrence Hall of Science, University of California, Berkley, California.

GRADE LEVELS: K-3
CONTENT & SKILLS: science
SOURCE: Virginia Institute of Marine Science, Sensing the Sea, 2-3

CLASSIFYING BEINGS'N THINGS

Process: Classifying

Behavioral Objectives:

The student will be able to:

Group things that are the same on the basis of a stated property

Group things that are the same on the basis of more than one stated property

Distinguish living from non-living things

Teaching Tips:

Classifying involves the arranging or grouping of objects or events according to a particular system. There are many ways of grouping objects; therefore, be sure to question your students in order to understand their basis of classification. As long as the objects or events conform to their designated basis for grouping, the classification is valid.

Preparation for This Lesson

Be prepared to develop the concepts of the following as life-defining characteristics:

moving (animals moving or leaves turning toward sunlight)

eating (plants--look up venus flytrap and share its eating habits with your students)

reproducing

growing

responding to stimuli

breathing

MATERIALS

four paper lunch bags containing eight shells in each

ten slides or pictures of living and non-living things (available from nature magazines, National Wildlife Federation publications, or Virginia Institute of Marine Science)

ACTIVITY ONE: Grouping Things

Provide each group of students with a bag of eight shells. State a single property such as color, size, shape, or texture and ask them to place the shells into two groups according to that property. (i.e. It has some red or it has no red.) Repeat after stating another property. All of the objects must be used.

Ask the children to place the shells into two groups allowing them to determine the property.

Ask why they grouped them that way?

Can you put them into two other groups?

Why?

Which is the right way?

(Any grouping is acceptable if it is consistent with the student-stated criteria.)

Can you group the objects on the basis of two properties?

For example: All of the things in this pile are smooth and white while all of these in the other pile are neither. Repeat the above two exercises using two properties.

Can you group these things on the basis of three properties?

Repeat.

ACTIVITY TWO: Alive Or Not?

Ask the class to begin naming all of the things in the aquarium. As they name things, list them in two groups.

Can you guess why I put them into these two groups?
(Group them into living and non-living)

They may see other reasons for grouping them; be sure to accept all valid suggestions.

"I am thinking of one way to group these things; however, there are many ways to group them. You have mentioned several. I have made a list to separate living things from non-living things."

Why did I put these things in the list of things that are alive?

What makes something alive?

Be sure to list all of their suggestions, correct and incorrect. Discuss and sort after all suggestions are in. Puzzle the children. Challenge both correct and incorrect statements. For example, if they suggest that living things move, you might mention that the ocean moves;

Have you ever seen a tree walking down the street?

Is a tree alive?

Why?

Call attention to the plants from lesson #1. Ask if they are alive.

Why?

Show ten slides or pictures of living and non-living things (marine oriented slides should be included along with more familiar plants and animals) and ask the children to state which is alive and which is not.

Why did you classify them that way?

Can you think of another way to classify them?

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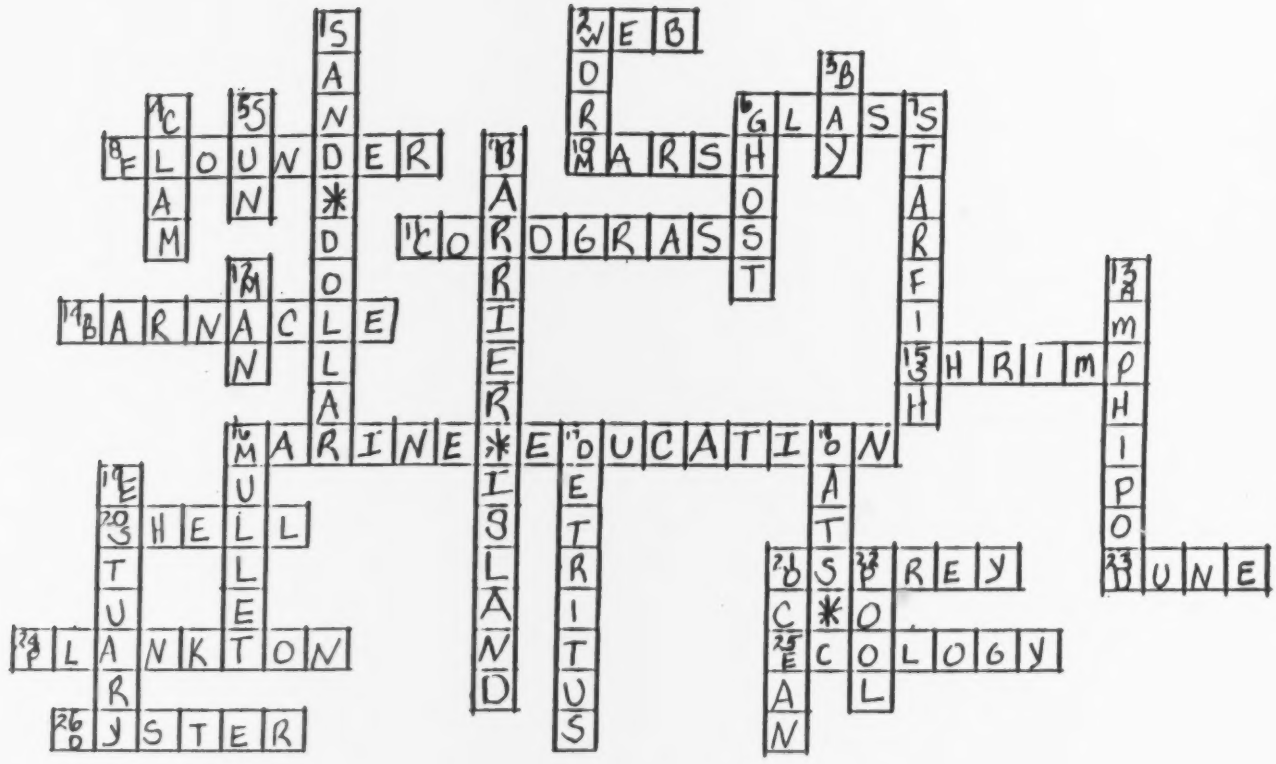
GRADE LEVELS: 2-8
CONTENT & SKILLS: science, reading, writing
SOURCE: original, Ben Baldy and J. Baxter Williamson, Jr.

CROSSWORD PUZZLE
(corrected)
Answer Key



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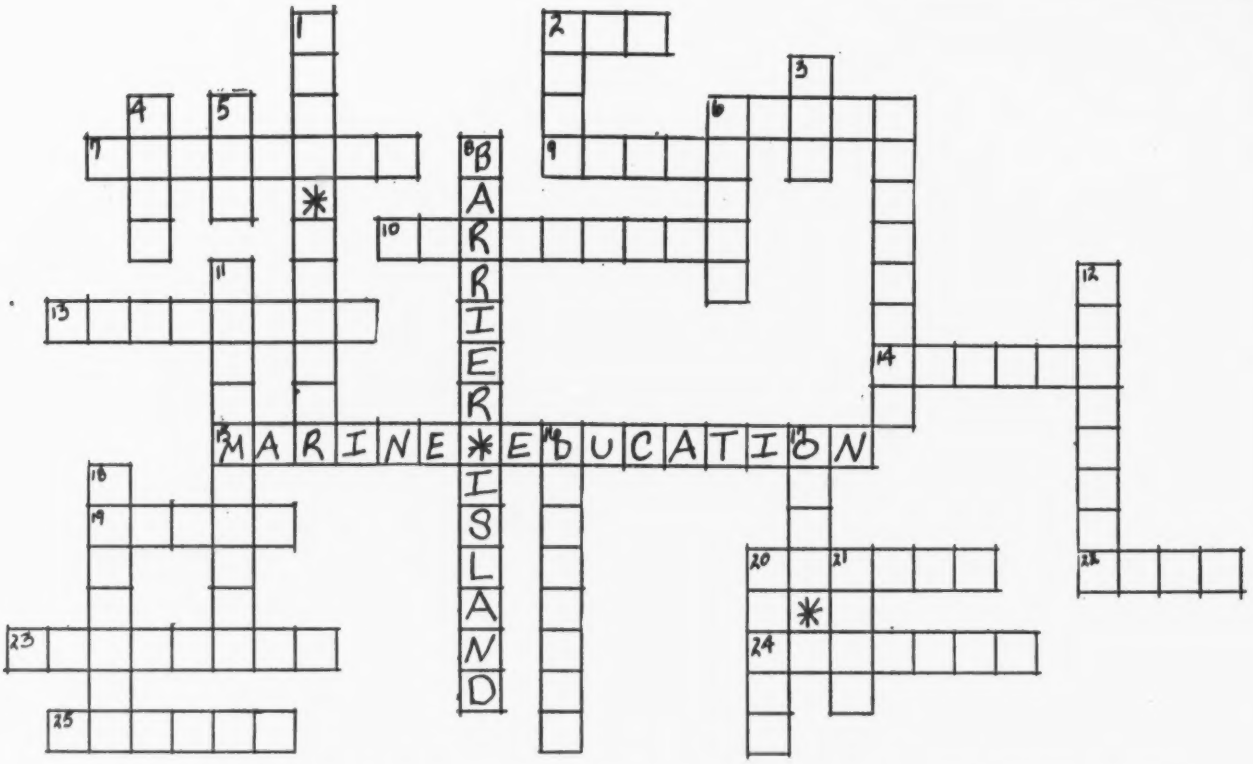
CROSSWORD PUZZLE

Name: _____



2. A collection of food chains, showing who eats whom.
6. ____ crabs dig along dry sandy beaches.
7. A flat fish with two eyes on one side.
9. The salt ____ is one of the most productive ecosystems on Earth.
10. The most common plant in the salt marsh.
13. A crustacean that attaches itself to hard substances like boats and pilings.
14. A crustacean that is caught in nets; SC's #1 commercial marine crop.
15. _____ lets you realize the total effect of salt and freshwater on the environment.
19. The hard outer covering of many animals.
20. Fish hawks.
22. Beach hills caused by wind.
23. Drifting plant or animal life in the water.
24. The study of plants, animals, the environment, and their relationships.
25. A tasty bivalve; top and bottom shells are different sizes.

1. A pancake-shaped, spiny skinned animal.
3. Body of water; examples include Winyah ___ and Chesapeake ___.
4. A bivalve; examples include quahog, coquina, and cherrystone.
5. Source of energy for all food chains.
6. _____ wort is another name for pickle plants.
8. A sandy strip on the oceanfront and separated from the mainland.
11. The well-being or decline of marine life is strongly influenced by this vertebrate.
12. One common name for this crustacean is sand hopper.
15. A common, silver, plankton-eating fish.
16. Decaying plant or animal matter.
17. Sea ___ are very common dune grasses.
18. Where marine and fresh water meet.
21. A tidal ____ is covered at high tide and exposed at low tide.

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GRADE LEVELS: 6-12
CONTENT & SKILLS: science, writing
SOURCE: Marine Science Project For Sea, Unit 6

TEACHER BACKGROUND - OCEAN CURRENTS

While this experiment can be done as a demonstration, it is recommended that the class be divided into small groups and that each group perform the investigations. This exercise deals with temperature and salinity currents. Emphasize that currents do exist and that they play an important and not all together understood role in the life of the oceans.

It is important that you do this experiment before your class performs it. This will give you a chance to anticipate any difficulties. Try the 3 x 5 card on the top of the flask inversion trick for yourself. It really does work. Be sure your flasks, or jars have flat lips.

Groups of 3 or 4 students allow participation by all members. Watch to see that some don't adopt a passive spectator role. Encourage careful observation and require written observations from the groups.

KEY - Interpretation - 1

1. Salt water is heavier. The colored salty water sank into the clear fresh water in experimental set up "a".
2. Since river water is fresh, it floats on top of the salt water until waves and currents cause the two to mix.
3. Freddy was fishing where the fresh water was standing in a layer above the salt water. Near the surface the water was the lighter river water, near the bottom the water was the more dense sea water.

KEY - Interpretation - 2

1. Warm water is lighter (lower density) than cool water. The warm, colored water remained in the upper flask in experimental set up "a".
2. Most heating occurs at the surface.
3. Most dilution of sea water occurs at the surface.
4. It is easier for a human to swim in salt water. The salt water makes the person more bouyant. Salt water is more dense and the same volume displaced by the person will weigh more, the person floats more easily.

5. It is easier for a human to swim in cool water. The person displaces the same volume but since the water is cooler and more dense it weighs more and the person floats more readily. A word of warning may be in order here. While a person will float more readily in cool water, the chance of excessive body heat loss increases. Cold water can lead to hypothermia. You may wish to discuss this so that your students use caution when experimenting on their own.

KEY WORDS

adjacent

climate

density

dilution

transport

OCEAN CURRENTS

People have observed ocean currents for many years. Currents are masses of water that flow in a definite direction. Ocean currents are important in many ways. They affect the climate of the lands nearby. The best fishing is often found where two currents come together. Currents can help transport boats. They also transport fish and shellfish that are too young to swim great distances.

There are several types of currents. The best known are wind-caused currents where the wind actually pushes the water along the surface. There are also deep currents beneath the surface. These currents are caused mainly by differences in the density of adjacent waters.

The experiment below will let you observe two of the lesser known factors that cause currents. You will observe differences in salinity and temperature densities between two masses of water.

MATERIALS

Two 1-pint milk bottles or two 250 milliliter Erlenmeyer flasks with flat rims

Some 3 x 5 cards

Table salt

Food coloring

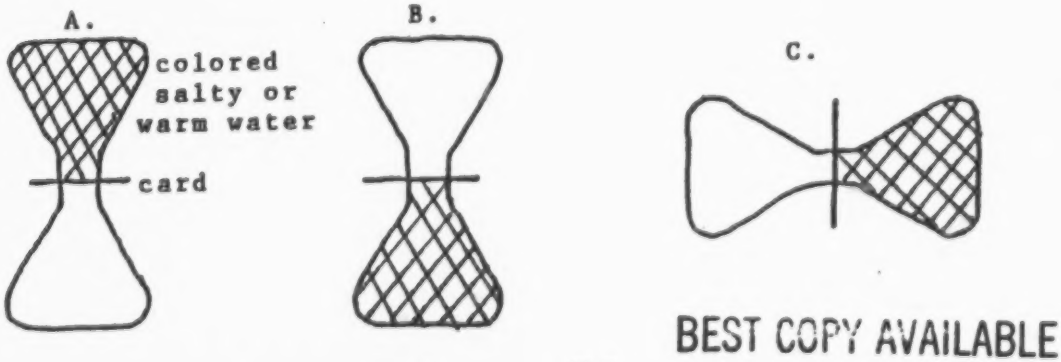
Paper towels or rags

Plastic dishpan or other container suitable to catch water

METHODS

Salinity Currents

1. Fill both bottles with water. Dissolve ½ teaspoon of salt in one bottle and add a drip of food coloring. Place a 3 x 5 card on top of the salt water bottle and carefully invert it; the upward pressure of air will hold the card in place (most of the time).
   a. Place the salt water bottle on top of the freshwater container and have someone remove the card. (Now is the time for the dish pan!) Observe results.
   b. Repeat No. 1 -- place fresh water jar on top of salt water jar, remove card and observe.
   c. Repeat No. 1 -- place both jars horizontally, remove card and observe.



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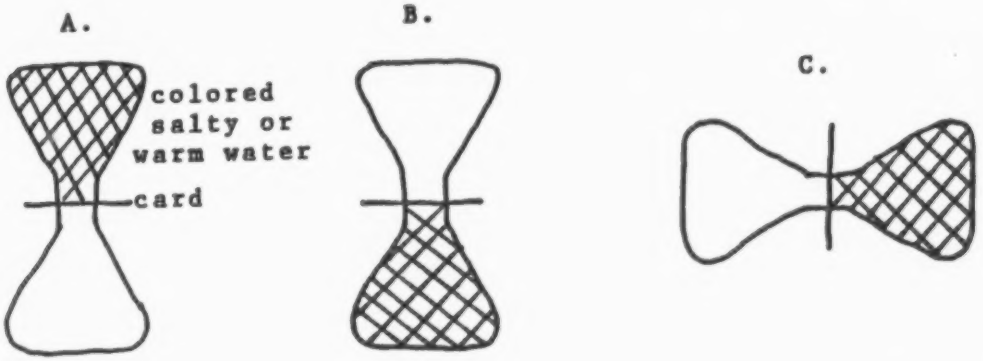
INTERPRETATION

1. Is salt water heavier or lighter (higher or lower density) than fresh water? Explain your answer in terms of the results you obtained from the experiment.
2. What happens to river water when it flows into the ocean?
3. Freddy Fisherman was fishing at a spot near the mouth of a river. Five feet down he caught a fresh water perch. His luck was so good he let out more line. At thirty feet he caught a salt water cod. Freddy is so excited about this strange occurrence he is going to call the Sports Editor of the Post-Intelligencer. What would you tell Freddy to save him from embarassment?

Temperature Currents

1. Fill one bottle with warm water and the other with cool water. Add a drop of food coloring to the warm water. Do the three variations listed above in No. 1. (see diagram below).



INTERPRETATION

1. Is warm water heavier or lighter (higher or lower density) than cool water? Explain your answer in terms of the results you obtained on the above experiment.
2. Where does most heating of ocean water take place?
3. Where does most dilution of sea water occur?
4. Is it easier for a human to swim in salty or in fresh water? Explain.
5. Is it easier for a human to swim in cool water or warm water? Explain.

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GRADE LEVELS: K-7
CONTENT & SKILLS: science
SOURCE: NC Marine Education Manual,
Coastal Ecology

FOOD CHAIN CONNECTIONS - A WEB OF LIFE

Objectives:
1. To create a food web with students to demonstrate the complex nature of food/ecological relationships.
2. To review roles (niches) in nature.

Teacher Preparation: String or yarn cut into 8 foot lengths to tie your class of students together in a food web.

Procedure:
1. Review some of the eating habits of marine organisms (you can go to whatever degree of complexity you desire). You need to mention plants (producers) and animals (consumers) and mention levels of consumers (herbivores, carnivores).
2. Have the class suggest marine organisms and discuss what they eat. Write the names of these organisms on the board.
3. To begin the string, ask for one or two volunteers to be producers (seaweeds, algae). Give them each one end of a length of string. Ask other students to be some of the animals mentioned on the board. Ask who will eat the plants. Let the plant people hand the herbivores the other end of the string. Give lengths of string to the herbivores to hand to carnivores which would eat them. (At this point, the students should see that one organism may be the food for several others and that one organism may prey upon several others.)

Discussion:
1. When the possibilities of interacting have been exhausted and your room looks like a New Year's Eve spider web, ask the students to reflect how complex a real food web is.
2. You may want to use the web to show how a diverse ecology can withstand some pressure. (Remove one part and see how many other components are affected.)

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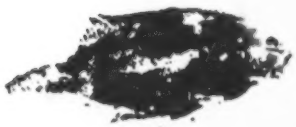
GRADE LEVELS: K-12
CONTENT & SKILLS: art
SOURCE: original, Wendy Beard Allen



GYOTAKU - JAPANESE FISH PRINTING

Gyotaku (pronounced ghio-ta-koo) is an age-old Japanese technique of fish printing which is used to record information on the physical features of fishes. The art of Gyotaku may also add interest to a study of the external anatomy of fishes.

Materials: newspaper, clay or corkboard, pins, water-based block printing ink, absorbent paper (rice, construction or manila), brushes, and some fishes; the flatter, the easier to print.

Procedure:

1. Set up a work area with a covering of newspaper.
2. Wash fish with soap and water to remove its slimy coating. Be careful not to scrub off the scales, if possible. (Save any lost scales for another fishy activity, see follow-up list below.)

3. Dry fish well.
4. Place fish on work spot and prop up any sagging fins with a combination of pins and clay or corkboard.
5. Paint a thin coat of ink onto fish, covering all parts except the eye which gives an interesting effect if left clear or painted later.
6. Lay a piece of paper over the fish and carefully press it against the fishes' surface.

It may take several tries to get a full impression of the fish but be persistent, learn from your rejected prints and remember to include that tricky fin or mouth region the next time.

The fish should receive a fresh coat of ink prior to each printing. Sometimes, however, two or three acceptable but lighter prints can be obtained before reinking is necessary.

ABOVE ALL, HAVE FUN EXPERIMENTING WITH COLORS, PATTERNS AND DIFFERENT FISHES!

Clean-up: Fishes may be washed and stored in a refrigerator or freezer for future printings or they may be dissected and contribute to a lesson on the internal anatomy of fishes.

Follow-ups: Identify the fish species and label the print, write a short story about the fishes' habits, make a collage which places the fish in its natural surroundings, study a scale and determine the fishes' age by counting its annual growth rings...

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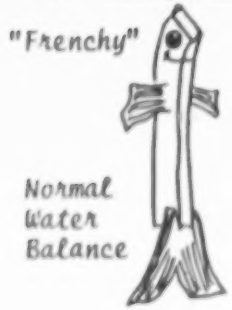
GRADE LEVELS: 4-7
CONTENT & SKILLS: science
SOURCE: NC Marine Education Manual,
Coastal Ecology

WHAT HAPPENS WHEN A SALT WATER FISH GOES "UP THE CREEK" OR INVESTIGATING OSMOREGULATION

1. Background: Osmosis is the flow of water through a semi-permeable membrane (semi-permeable membranes allow only water molecules to pass through) from high to low concentrations of water. Thus, marine fish with body fluids containing higher concentrations of water than the seawater surrounding them constantly lose water through cell membranes. Freshwater fish with body fluid water concentrations lower than lakes or streams will gain water. Both tendencies must be countered to preserve body fluid water balance. A few fish or invertebrates survive where salinities range both above and below body fluid water concentrations. Most are adapted to only one end of the spectrum and thus are confined to marine or fresh water, and cannot tolerate the variable environment of estuaries.



Marine bony fish (as opposed to cartilaginous fish like sharks) lose water through gills and mouth and would become dehydrated except for adaptations designed to restrict water loss. These adaptations include (1) drinking seawater and excreting salt through the gills to offset the loss; (2) conserving water usually lost as urine by an elaborate kidney system. Freshwater fish on the other hand, do not drink large quantities of water and do excrete copious amounts of dilute urine. When fish enter estuaries, they must be able to adjust their water balance (osmoregulate). Marine fish have this ability to a greater degree than do freshwater fish. The adaptability of marine fish is largely dependent on low permeability of their body surfaces to water (thick scales and mucous membrane) and extraordinary salt regulating activities of gills and kidneys. Most estuarine fish return to the sea for spawning.

2. Objectives: To investigate how changes in the concentration of water affect the water balance in living cells.

3. Teacher Preparation: There are several experiments to demonstrate this phenomenon. This one is the easiest. Cut a fresh potato into slices. Place half the slices in a bowl with tap water and the other half in a bowl with salty water. Have the students feel the potatoes at the start and then feel them after 30 minutes or more. The potato slices cannot

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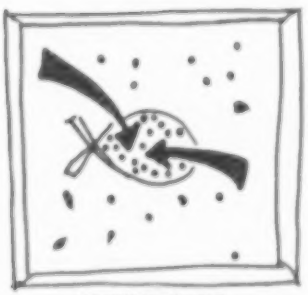
regulate their water balance and therefore are altered by their environment. This represents what would happen if a fresh water fish were dropped into the sea or a marine fish dropped into a lake - both would die eventually. Estuarine organisms have mechanisms for maintaining water balance as explained above.

4. Procedure: Feel the potato slices in both tap and salt water at the start of the period. Repeat this at the end of the period and record the changes which have occurred.

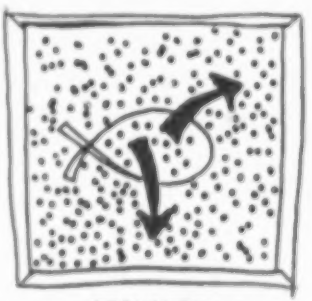
5. Discussion:
   1. What happened to the potato slices left in fresh water? Relate this result to a marine fish being dropped into fresh water, what would happen to it? (Potato slice becomes very stiff, cells have absorbed maximum amount of water. A marine fish would also swell and probably his cells would burst.)

   2. What happens to potato slice left in salty water? Relate this result to a freshwater fish dropped into the ocean. (Potato slice becomes limp; cells have lost water and become dehydrated. A fresh water fish would become dehydrated.)



FRESHWATER

High Concentration of Water Outside Cell. Water Flows In. Result: Bloat



SEAWATER

Higher Concentration of Water in Cell. Water Flows Out. Result: Desication

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GRADE LEVELS: 2-12
CONTENT & SKILLS: science, math, writing
SOURCE: Marine Science Project For Sea, Unit 6

TEACHER BACKGROUND - THE MARINE AQUARIUM

This exercise consists of three activities. All of the activities center on the marine aquarium in your classroom. If you do not have a marine aquarium, the activities can be modified for use with a fresh-water system or omitted.

Duplicate the three pages of activities. One set per student. Provide additional Animal Identification pages as needed. Activity one is a simple listing of the animals present in the aquarium. Provide reference materials that describe the animals your aquarium contains. Let the students discover the identities with your aid.

Activity two gives the student a chance for a more in-depth look at some of the animals in the tank. Again provide the reference materials for the students to complete the forms.

Activity three is a simple log of water temperature along with additional observations. You can either take the readings yourself and post them on the board or you can have groups of students take and post the readings.

The temperature should be recorded at the same time each day. If you have your students record the temperature at several times during the day you may notice differences. These observed changes can be a springboard for a discussion designed to find correlations between the temperature changes and classroom activities. For example, the temperature may go down each day at recess time because the classroom door is left open, etc.

These activities can be done individually.

KEY WORDS

aquarium

appendages

identification

marine aquarium

observation

pH

predator

THE MARINE AQUARIUM

The marine aquarium in your class contains salt water and salt water animals. Marine animals are very interesting to watch. We can also learn about the marine environment from the animals in the aquarium. Use the marine aquarium to do the next activities. List the animals you can see in your aquarium.

Fill out an animal identification form for as many animals as you can.

Make and record daily observations on the marine aquarium.

THE MARINE AQUARIUM - ANIMAL INVENTORY LIST

NO.	ANIMAL NAME	NO.	ANIMAL NAME
1.	_____	21.	_____
2.	_____	22.	_____
3.	_____	23.	_____
4.	_____	24.	_____
5.	_____	25.	_____
6.	_____	26.	_____
7.	_____	27.	_____
8.	_____	28.	_____
9.	_____	29.	_____
10.	_____	30.	_____
11.	_____	31.	_____
12.	_____	32.	_____
13.	_____	33.	_____
14.	_____	34.	_____
15.	_____	35.	_____
16.	_____	36.	_____
17.	_____	37.	_____
18.	_____	38.	_____
19.	_____	39.	_____
20.	_____	40.	_____

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THE MARINE AQUARIUM - ANIMAL IDENTIFICATION

1. Name of animal: _____

_____

2. Color of animal: _____

3. Describe shape of animal: _____

4. Describe how animal moves: _____

_____

_____

If the animal is not moving, describe how it could possibly move. _____

Draw your animal

_____

Why is there a need for this animal to be able to move: _____

_____

5. Number and description of appendages (arms or legs): _____

_____

6. Approximate size of this animal in centimeters: _____

_____

7. What do you think this animal eats: _____

_____

8. Describe how you think this animal eats: _____

_____

9. Name of predator (enemy): _____

10. How does this animal protect itself: _____

_____

_____

11. What interesting characteristics or habits does this animal have:

_____

_____

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THE MARINE AQUARIUM - OBSERVATIONS AND MEASUREMENTS

Water temperature

Mon.	Tues.	Wed.	Thurs.	Fri.

Mon.	Tues.	Wed.	Thurs.	Fri.

List anything added or taken from the aquarium:

Observations:

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GRADE LEVELS: 5-8
CONTENT & SKILLS: reading, social studies
SOURCE: NC Marine Education Manual, Coastal Beginnings

MAROONED ON A BARRIER ISLAND

Objective: To simulate how man develops a culture by adapting to his environment.

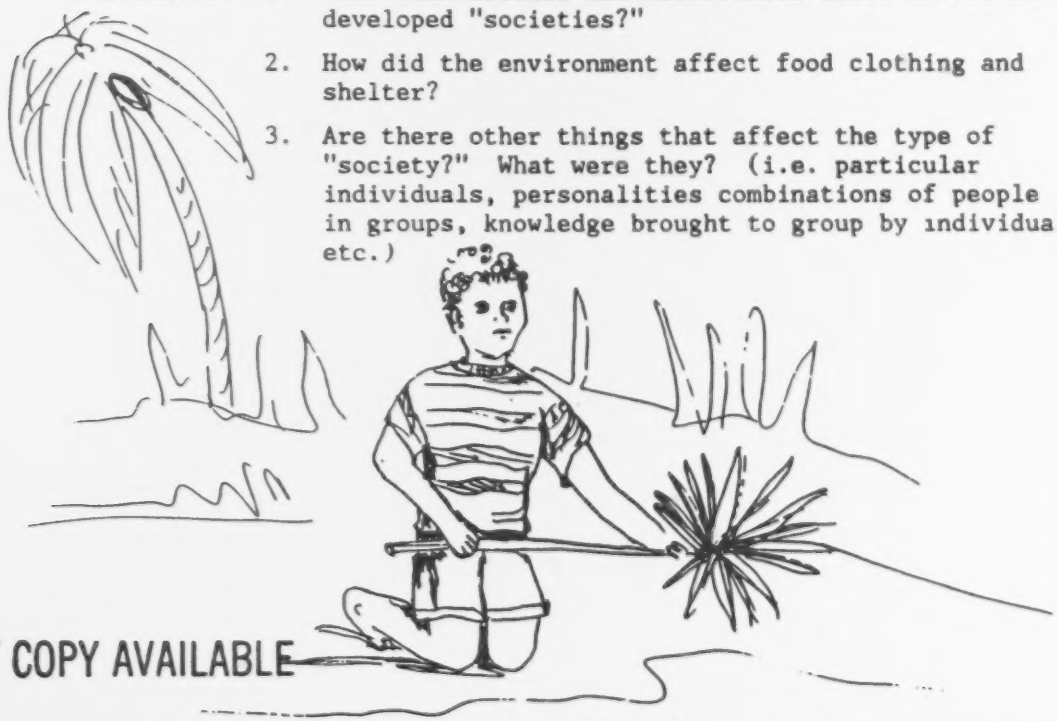
Teacher Preparation: List the following items on the board:

fresh water	grasses	snakes
salt water	turtles	raccoon
maritime forest	muskrats	shore and sea birds
salt marshes	rabbits	crustaceans
sand dunes	squirrel	shell fish
shells	deer	fish

Divide the class into small groups.

Activity: Inform the students that they are marooned on an uninhabited barrier island with nothing but the "clothes on their backs." It is spring and they must use the above available natural resources to develop a system of living. This should include a means of providing food, clothing and shelter. Depending on the level of the students, an economic system, government and religion can also be developed.

Discussion:
1. What similarities and differences exist in the newly developed "societies?"
2. How did the environment affect food clothing and shelter?
3. Are there other things that affect the type of "society?" What were they? (i.e. particular individuals, personalities combinations of people in groups, knowledge brought to group by individuals. etc.)



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GRADE LEVELS: 2-9
CONTENT & SKILLS: science, math, writing
SOURCE: Marine Science Project For Sea, Unit 4

TEACHER BACKGROUND - OBSERVING THE LIVING CRAB

This is a lab exercise involving one or two hours. It may be done over two days. The crab is an ideal laboratory specimen in most areas because:

1. It is easy to keep alive and is relatively available.
2. It is large enough so that the various parts can be seen without the aid of a microscope.
3. It shows outstanding specialization of appendages. Form and function can be easily related.
4. If you choose the right kind of crab, you can have a very nice dinner after the exercise is completed!

WHERE TO GET CRABS

If you live near the coast you can probably collect your own crabs. Fiddler crabs are easily obtained in the salt marsh at low tide. With a little work, stone crabs or blue crabs can be taken with a net or crab pot. Be sure to check local regulations for size and number limits and for season length. Crabs may also be obtained from fish wholesalers. A live crab is best but a frozen crab will allow much of the exercise to be completed. Biological supply houses also supply live crabs at a reasonable cost. For example: Carolina Biological Supply, 2700 York Road, Burlington, North Carolina 27215. Pet shops often sell hermit crabs for pets. Most of the exercise could be completed using hermit crabs.

Cautions: Crabs need to be kept moist. They can be entirely submerged in salt water, but they will also do well if they are partly submerged. Crabs have a rather strong grip. Avoid being gripped! Grasp the crab across the back. Watch the action of the pincers. A preview of crab handling is recommended before doing this exercise with your class. This exercise may be done as a demonstration or as a small group activity. Groups of three or four students is ideal. If student groups perform the activity, it is best to use small shore crabs. Demonstrate the proper handling methods to the students and observe the handling carefully.

KEY WORDS -

abdomen
antennae
appendages
aquarium
average
caliper width
habitat
pincers
stalks
structures
survive
swimmerets
weight

OBSERVING THE LIVING CRAB

The crab is a very interesting creature. Carefully watch this animal. How do its body structures help it to survive in its habitat?

Watch a live crab in an aquarium.

1. How does the crab move? _____

_____

2. How many appendages (legs, etc.) does the crab have? _____

_____

3. Can the crab swim? _____

_____

4. What appendages does the crab use in walking? _____

_____

5. Are any of the crabs forming new appendages? _____

_____

6. How does the crab dig in the sand? _____

_____

7. How does the crab catch live food? _____

_____

8. What appendages are used in getting food to the mouth? _____

_____

9. Can you see where water enters the gill chamber? _____

Use your drawing of the crab to help you find the following:

The eyes on stalks

The heavy pair of pincers

The four pairs of walking legs

Lift up the abdomen and observe the feather-like appendages called swimmerets.

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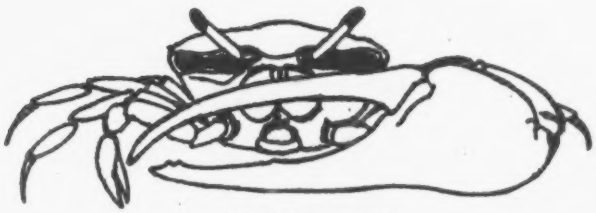

Fiddler Crab

10. Look at the shape of the abdomen. What sex is your crab? _____

11. Can you find the antennae that are near the eyes? _____

12. How wide is your crab (caliper width)? _____

13. How wide is the widest crab in the class? _____

14. How wide is the narrowest crab in the class? _____

15. Estimate (make an educated guess) the width of the average crab. (A crab about halfway in-between the biggest and smallest). _____

16. Find the true average. Do the Following:

    a) add all of the widths.

    b) divide by the number of crabs measured.

    Your answer is the average.

See how powerful your crab's pincers are. DO NOT PUT YOUR FINGER IN-BETWEEN THEM. Place your pencil in between the pincers. Try to lift up the crab using your pencil. Be careful not to lift the crab too high. You only need to see if he is powerful enough to lift his own weight.

17. Can your crab hold up his own weight with one pincer?

_____

18. Can you lift yourself up from the ground with only one arm?

_____

19. Pound for pound, who do you think is stronger?

_____

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GRADE LEVELS: 4-7
CONTENT & SKILLS: math
SOURCE: Marine Science Project For Sea, Unit 4

TEACHER BACKGROUND - OPEN FOR BUSINESS

This activity permits your students to make some simple economic comparisons of two hypothetical businesses. The activity also provides some practice with practical work problems. Again, the choice is up to you regarding how to handle the activity. You may elect to have the students work independently or in small groups. Each student or group should have a copy of the exercise. Duplicate the needed material prior to class use.

OPEN FOR BUSINESS - TEACHER KEY

1. 1,500 lbs x $2.00/lb. = $3,000.
2. 800 lbs. x $3.00/lb. = $2,400.
3. SEASALMON FARMS, INC. looks like the best investment.
4. $250.00 + $1,000 + $300.00 = $1,550.
5. $75.00 + $200.00 + $600.00 = $875.
6. SEASALMON FARMS has the greatest expenses for one year.
7. $3,000 - $1,550 = $1,450.
8. $2,400 - $875.00 = $1,525.
9. WATERBED OYSTER CO. has the largest net profit.
10. The best investment is the WATERBED OYSTER CO.

OPEN FOR BUSINESS

Lucky you! You have just won one thousand ($1,000) dollars in the MacDonald's "Name that Burger" contest. Since you are now a rich person, all of your friends want to help you spend your money. You have decided to start a business. There are two choices which sound good to you. One is a salmon farm. The other is an oyster bed. You will have to use the information below to pick which business to buy.

SEASALMON FARMS, INC.

Income:

Pounds of salmon sold a year 1,500

Price per pound $2.00

Expenses:

5,000 salmon eggs $250.00

Fish food $1,000.00

Packing and delivery 300.00

WATERBED OYSTER CO.

Income:

Pounds of oyster meat sold a year .. 800

Price per pound $3.00

Expenses:

Oyster spat $75.00

Oyster shells $200.00

Shucking and delivery $600.00

PLEASE SHOW YOUR WORK

1. What is the total income of the SEASALMON FARMS, INC. for one year? (Hint: Multiply the number of pounds times the price per pound.)

2. What is the total income of the WATERBED OYSTER CO. for one year?

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3. From the total incomes, which business looks like the best investment for your winnings?

4. What are the total expenses for SEASALMON FARMS, INC. for one year? (Hint: Add each expense item to find the total.)

5. What are the total expenses for WATERBED OYSTER CO. for one year?

6. Which business has the greatest expenses for a year of operation?

As president, your salary will be the NET PROFIT from the operation of your business. Net profit is the total income minus the total expenses.

7. What is the net profit for SEASALMON FARMS, INC. for one year?

8. What is the net profit for WATERBED OYSTER CO. for one year?

9. Which business has the largest net profit?

10. Which business is the best investment?

GOOD LUCK AND DON'T FORGET TO HAVE A GRAND OPENING SALE!

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GRADE LEVELS: K-12
CONTENT & SKILLS: science, writing, math
SOURCE: NNEMEP, What Adventures Can You Have in Wetlands, Lakes, Ponds, and Puddles?

PICKLE JAR PONDS AND PLASTIC PUDDLES

Objective: To create indoor wet environments for observation and study.

Materials:

- Several large glass jars
- Living plants and animals collected from the pond
- A children's plastic swimming pool

Timing:

One class period for establishing the environment, up to several more for observation and study.

Procedure for a Pickle Jar Pond:

Obtain large glass containers for each small group of students; three students to a jar is a workable number. The lunch program in your school may have two- or three-gallon jars with lids.

Each jar will become its own closed system. Plan for one period of creating the systems with ingredients brought from home by students or perhaps gathered by the class on a field trip. If you use tap water, allow it to dechlorinate for forty-eight hours before you introduce living organisms. It is better to use pond water.

Place a small amount of sand in the bottom of your pickle jar pond. Add rooted aquatic plants such as Elodea and floating ones, such as duckweed. Include small animals like snails, and small fish, and water insects. Make the jar airtight and place it in a sunny window. The first class could include the use of field guides to identify and learn about the plants and animals being observed. During the first few days organisms may have to be added or removed to achieve a balanced system. The amount of light may also need to be changed.

You will want to have your students observe carefully and respond to thought-provoking questions based on their observations. You may wish to have each group keep a journal of thoughts, observations, and answers over a period of time. The ponds will last all year.

- How does your closed system differ from ecosystems in nature?
- What food chains do you have in your pond?
- What is the ecological niche of each organism, plant, and animal?
- What niches are occupied by organisms you cannot see? You may wish to introduce microscope use here.
- Study, with field guides and other books, the morphology and physiology of microscopic organisms.

- Write about the flow of energy through your ecosystem.
- Undertake a population count of the macroscopic animals in your pond. Graph the results.

You may wish to have groups undertake experiments such as altering the amount of light available. You may wish to divide your pond into small jars first, so as to provide control on your study. What happens when we tamper with our balanced system?

Procedure for a Plastic Puddle

To create a plastic puddle you will need a small children's swimming pool, preferably of hard plastic form. With the student's help in bringing jars of pond water and pond life to school, create a puddle environment indoors. You'll want the water to fill the pool to a depth of 15 cm or less. Introduce hay, salamander eggs, algae, frog egg masses, aquatic insects, and so on.

This is a good spring activity. You are creating an environment which in nature study is called a vernal pond - a brief seasonal body of water rich in aquatic life.

Allow time each day to observe the pond. Another unit in this series, Have You Been to the Shore Before? provides good aquarium observation activities.

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GRADE LEVELS: K-5
CONTENT & SKILLS: science, writing
SOURCE: NC Marine Education Manual, Coastal Ecology

POTATO FISH

Objective: To design a fish with functional parts suited for its habitat; to learn the external parts of a fish.

Teacher Preparation: This activity can be demonstrated with you holding the potato (or piece of styrofoam cut into a fish shape) and asking for suggestions or can be done in small teams. The body shape is represented by a potato with fins, mouth, eyes, etc. represented by stiff pieces of cardboard or construction paper. These are stuck into the "fish". Before doing this, review the different types of fins, positions of mouths, and other adaptations.

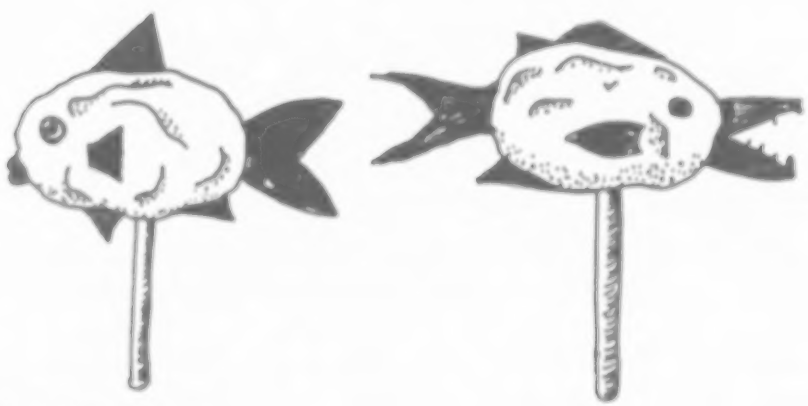
Procedure:

1. Discuss where you want your fish to live, what it ... would eat, how it would protect itself from enemies. Write down the results of the discussion.

2. Place cut-out fins, mouth and eyes on the potato in the shape and position which would allow this "fish" to survive in the habitat you have described.

3. When several of the "potato fish" have been finished, the students should compare and try to analyze the habitat of their friends' "potato fish".

Discussion: What characteristics are the best suited for defining where and how a fish lives? (body shape, fins, mouth design)



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GRADE LEVELS: K-3
CONTENT & SKILLS: math, science
SOURCE: Virginia Institute of Marine Science, Sensing the Sea, K-1

ROCKS AND SHELLS

(estimated class time: one or two 30 minute sessions)

PROCESSES: Observing, Counting, Comparing

MATERIALS

plastic or oil cloth to cover tables

shoeboxes

small rocks - collected outside

shells (clams, oysters, snails, crabs)

magnifiers

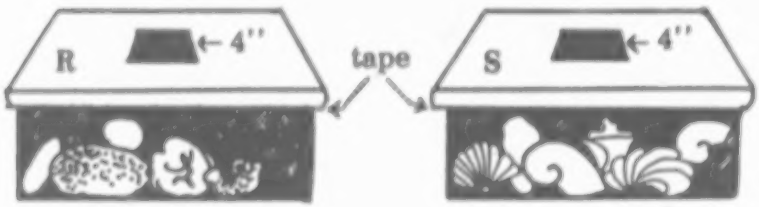
magnets

six boxes (shoe-box size)

Preparation for Class:

Divide the class into their original groups.

Label three shoebox size boxes R and three, S. Place four or five rocks in each of the boxes labeled R. Place four or five shells in the boxes labeled S. Cut a hole 4" by 4" in the lid of each of the boxes. Seal the edges of the covers with tape as shown below.



Treasure Chest:

Have your students put their hands through the holes into each of the boxes. Use the following questions, or any that you generate, to encourage careful observation and discussion.

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How do they feel? Smell?

What did you use to find out?

Do the objects in the boxes feel the same? Different? How?

Are they rough or smooth?

Do they feel like anything that you have ever felt before?

How many sounds can you make in each box?

Are the sounds the same in each box?

What did you use to hear the sounds?

Which box contains something that is easier to hold on to?

Why?

How many pieces can you count in each box?

Are the objects in each box the same size? Shape?

What shapes are they?

Are they the same on all sides?

Do they have edges?

Are the edges sharp?

What colors are the objects?

How can you find out?

Do you know for sure without opening the boxes?

Why?

What do you think is inside the boxes?

Explorer's Eye:

Have your students place one object from each of the two boxes used in the Treasure Chest Activity onto a plastic covered table. Provide magnifying glasses and magnets for each group of students.

In what ways do they look the same? Different?

Which object is heaviest?

How many colors can you find?

Are they both the same size? Shape?

Are the objects like anything that you have ever seen before? What?

Are they rough or smooth?

Which is rougher?

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Which is smoother?

Are they hard or soft?

What happens when you place a magnet over the objects?

Does anything happen?

What things stick to a magnet?

Would the objects float or sink?

How could you find out? (Try it.)

Could an animal use either of these things? How?

Where would you go to find each of these objects?

Flipper's Fantasy:

This activity may best be carried out together as a class as part of a creative expression lesson.

What if you were an animal living in the rocks? Shells?

How would you move from one place to another?

What kind of home would you build?

How would you hide from other animals who might want to eat you?

How would you get your food?

What would you look like?

How would you look (eat, move, or hide) differently than an animal who lives in the sand and gravel?

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SOURCE MATERIALS AND ORDERING INFORMATION

PROJECT	MATERIALS
1. Bellefield Nature Center P.O. Box 1413 Georgetown, SC 29442	Materials provided with field studies conducted by Bellefield Nature Center
2. Marine Science Project: FOR SEA 17771 Fjord Dr. NE Poulsbo, WA 98370	2, Marine Science Activities ($25.00) *4, Marine Science Career Awareness ($25) *6, Marine Science Activities ($25.00)
3. North Carolina Marine Education Manual UNC Sea Grant NC State University 105 1911 Building Raleigh, NC 27607	Coastal Geology, UNC-SG-78-14A ($1.00) Seawater, UNC-SG-78-14B ($1.00) *Coastal Ecology, UNC-SG-78-14C ($1.50) *Coastal Beginnings, UNC-SG-78-14E ($2.00) *Connections, UNC-SG-82-1F ($2.00)
4. Northern New England Marine Education Project Marine Advisory Program 30 Coburn Hall University of Maine Orono, ME 04469	Have You Been to the Shore Before? *What Adventures Can You Have in Wetlands, Lakes, Ponds, & Puddles? What is Our Maritime Heritage? How do People Use Lighthouses and Navigational Charts? Is Our Food Future in the Sea? Do You Know Our Marine Fish? Do You Know Our Marine Algae? What are the ABC'c of Marine Education? (all units are $5.00. Checks should be made payable to Marine Advisory Program.)
5. Project CAPE Dare County Schools P.O. Box 640 Manteo, NC 27954	Water World Creatures ($4.75) *A Sea Creature Treasury ($3.50) Coastal Ecosystems ($4.50) Coastal Livelihood and Crafts ($3.50) Navigation ($3.50) Early Maritime Cultures of NC ($3.50)
6. US Fish & Wildlife Service Office of Extension Education Washington, D.C. 20240	*Freshwater Habitat Pac Endangered Species Issue Pac (may be out of print, write for information)
7. Virginia Institute of Marine Science Marine Education Center Gloucester, VA 23062	*Sensing the Sea, K-1 ($2.00) *Sensing the Sea, grades 2-3 ($2.00)

*Sources of activities included in Sampler

SEA SAMPLER EVALUATION

Please complete and return to: SEA SAMPLER, USC Baruch Marine Lab, PO Box 1630, Georgetown, SC 29442. Thank you.

School District: _____ Date: _____

Grade(s) or other learner group you teach: _____

Subject(s) you teach: _____

1. Please evaluate the activities you have used on a scale of 1(ineffective) - 3(very effective) and comment on their strengths and weaknesses.

A Beach Study 1 2 3

comments: _____

Beach Exploration 1 2 3

comments: _____

Exploring the Pond Community 1 2 3

comments: _____

Freshwater Marsh-Marsh Settlers 1 2 3

comments: _____

Freshwater Marsh-Marsh Succession 1 2 3

comments: _____

Salt Marsh Discovery 1 2 3

comments: _____

Salt Marsh Field Study 1 2 3

comments: _____

Clam Siphons 1 2 3

comments: _____

Classifying 1 2 3

comments: _____

Crossword Puzzle 1 2 3

comments: _____

Currents 1 2 3

comments: _____

Food Chain Connections 1 2 3

comments: _____

Gyotaku 1 2 3

comments: _____

Investigating Osmoregulation 1 2 3

comments: _____

(more)

The Marine Aquarium 1 2 3

comments:_____

Marooned 1 2 3

comments:_____

Observing the Living Crab 1 2 3

comments:_____

Open for Business 1 2 3

comments:_____

Pickle Jar Ponds 1 2 3

comments:_____

Potato Fish 1 2 3

comments:_____

Rocks and Shells 1 2 3

comments:_____

2. How many students participated in the activities? _____

3. Did the activities increase student interest and/or learning? _____ (yes), _____ (no)

Please comment:_____

4. Please describe how you used the activities (ie: infused into science lesson, incorporated into environmental studies course, etc.)

5. Did you purchase any of the activity source materials? _____ (yes), _____ (no), _____ (plan to).

If yes, which one(s) and what do you think of them?

6. How can this Sampler be improved? (ie: more or fewer activities, different selection, etc.)

7. Recommendations for additional activities or resources materials for South Carolina are welcome.